ANOTHER PERSPECTIVE ON CONSONANT HARMONY IN DUTCH

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Another Perspective on Consonant Harmony in Dutch

by

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Abstract

In this thesis I investigate patterns of consonant harmony in Dutch which appear to be at odds with consonant harmony data from other languages such as English and French. In order to achieve this, I undertake a recompilation of the original Dutch data. I examine two individual case studies involving children from a corpus documenting phonological development in Dutch. I describe these case studies from both qualitative and quantitative perspectives, in order to provide a representative account of the factors driving harmony. This study reveals that a series of production strategies exist (mainly of segmental substitutions) that are independent from harmony itself but that result in harmonized forms. I demonstrate that the tendencies observed in the data are largely predictable from the general phonotactics of the language which, I hypothesize, affect the children's analysis of their language and, as such, yield the production strategies observed in the data.

Acknowledgements

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Chapter 1 - Introduction

Across languages, children acquiring their target mother tongues display a number of emergent phonological processes that have no correlates in the adult version of the language they are learning. These processes include, but are not limited to, syllable truncation, velar fronting and consonant harmony (see, e.g. Bernhardt and Stemberger 1999 for a survey of the processes attested in phonological development). Production strategies such as these reveal aspects of the child's developing grammar and of other factors constraining child language such as physiological and articulatory limitations. In this thesis, I investigate the process of consonant harmony, which can be briefly defined as a long-distance featural agreement relationship between consonants. Consonant harmony as observed in child language is an emergent process, one which is not attested in adult languages (e.g. Pater 1997) and whose origins are yet to be determined, especially since its manifestations vary across languages and language learners (e.g. Pater 1997, Rose 2000, Fikkert and Levelt 2004). This thesis takes variation across languages as its starting point. Indeed, there exist differences in the manifestation of consonant harmony in children learning English, French and Dutch. As a result, analyses previously developed for any of these languages cannot always account for patterns found in the other languages. For example,as argued by Rose (2000), some of the differences between the manifestations of consonant harmony in French versus English can be accounted for by examining the metrical (stress) structure of the languages, which defines prosodic domains (e.g. foot, prosodic word) within which harmony takes place. The Dutch data,

however, appear to be at odds with the English and French data. On the whole, as opposed to what is observed in English or French, the vowel intervening between the harmonizing consonants seems to play a role in the Dutch data. No work published thus far even attempts to provide a cross-linguistic explanation for this peculiarity.

The researchers who have investigated Dutch consonant harmony patterns have interpreted them as an artifact of partial specification of place features within the word, which results in forms that display place identity between consonants and vowels (Levelt 1993, Levelt 1994, Levelt 1996, Fikkert and Levelt 2004), rather than as relations between consonants irrespective of intervening vocalic material (Smith 1973, Spencer 1986, Goad 1996, Pater 1997, Rose 2000). This leads to the question as to why Dutch-learning children should be any different from learners of other languages. In addition, one can wonder whether the apparent difference between Dutch learners and learners of other languages is an artifact of the different methodologies used by the researchers. Indeed, the Dutch data have thus far been reported in a way that prevents a systematic comparison with the English and French data. In order to investigate this issue further, the Dutch data need to be revisited using a method comparable to the ones used by researchers who have focused on English and French. Essentially, the differences between the two methods lie primarily on the focus of the compilation. While Levelt and Fikkert base their findings primarily on the shape of output forms, researchers such as Pater and Rose instead focus on the target forms and how these forms are affected by the harmonizing processes.

To address these issues, I look in this thesis at two case studies of children from the original study of consonant harmony in Dutch by Levelt (1994). I look at the data from these children from both qualitative and quantitative perspectives in order to provide a representative account of production strategies appearing in the children's outputs. I address each of the cases of apparent consonant harmony at first from the perspective of the place of articulation of the targeted consonants. I then examine all attempted cases of these targeted segments to determine what production strategies affect these segments. In addition, I discern which of these patterns result in apparent harmonized forms. At each step of this investigation, quantitative data are also collected in order to report on the representativity of the qualitative data discussed.

This study reveals that there are a series of production strategies that are independent from harmony itself that result in harmonized forms. A majority of the apparent cases of consonant harmony found in the outputs of both children are cases of apparent coronal harmony. I demonstrate that most of these cases result from a pattern of segmental substitution which targets consonants whose production is problematic for the children. I argue that phonological and statistical properties of the Dutch language conspire to produce these apparently harmonized forms. That is, coronal segments are highly frequent and are distributed in such a way that they have special status in the language input received by children. This predisposes children to select coronals as default consonants and, thus, use them as substitutes for other sounds. This, linked with the high frequency of occurrence of coronal segments in the language yields forms displaying harmony on the surface.

This thesis is organized as follows. In chapter 2, I provide background information about consonant harmony and summarize previous studies investigating this process. I also discuss the method used in the current study. In chapter 3, I discuss the coping strategies affecting Jarmo's speech productions that result in apparent cases of consonant harmony. I consider similar issues arising in Eva's productions in chapter 4. I discuss the patterns observed in these children's speech, in chapter 5, in light of the special status of coronal segments. Finally, I provide my concluding remarks in chapter 6.

Chapter 2 - Previous Studies and Methodology

1. Background

Consonant harmony refers to featural agreement relations between consonants. These agreement relations in child language generally target major places of articulation (POA; i.e. Labial, Coronal and Dorsal) and, to a lesser extent, manner and voicing features, as seen in examples (1) through (3), respectively.

(1) 'duck' /dʌk/→ [gʌk] trigger = DORSAL, target = CORONAL (Berg and Schade 2000: 4)

(2) 'pudding' /pudiŋ/→ [pupiŋ] trigger = LABIAL, target = CORONAL (Berg and Schade 2000: 4)

(3) 'light' /lait/→[dait] trigger = -CONTINUANT, target = +CONTINUANT (Goad 1996: 192)

As we can see in (1), the target consonant /d/ of the word 'duck' takes on the dorsal place of articulation of the final consonant /k/, yielding the velar-harmonized form [gʌk]. This is an example of primary place of articulation assimilation. Example (2) illustrates both primary place of articulation and voicing assimilation. The target /d/ of the word 'pudding' takes on the labial place of articulation and the voiceless quality of the initial consonant /p/, yielding a voicing and labial-harmonized form [pupiŋ]. (Note here, however, that it is unclear from the data provided whether the child had acquired voicing contrasts at the time when this example was produced.) Example (3) illustrates

manner assimilation: The target /l/ of the word 'light' takes on the manner of articulation of the final consonant /t/, yielding a form harmonized in manner, [dait].

We can also see from these examples that child consonant harmony takes place in morphologically simple words, i.e. without any morphological conditioning. This is not surprising since consonant harmony typically occurs in early forms, at a stage when very few morphological operations, if any, have been mastered by language learners (e.g. Smith 1973).

In this chapter, I will review patterns of consonant harmony found in English-, French- and Dutch-learning children. I will then compare the analyses proposed to account for the evidence found in each of these languages.

2. Patterns of Consonant Harmony in English

Smith (1973) conducted a study of the phonological acquisition of his English-learning son Amahl and found systematic cases of consonant harmony. In these data, some of which are reported in (4), we see bidirectional velar harmony affecting coronals (i.e. both regressive and progressive). There are examples of regressive harmony affecting coronals. In [Labial...Dorsal][1] and [Dorsal...Labial] target forms there is bidirectional velar harmony. In addition, as noted by Rose (2000), there is no difference between words with a CVC shape and those with a CVCV shape with regard to the manifestation of consonant harmony.

[1] The schema [Articulator...Articulator] refers to the discontinuous sequence of POA of the target and actual forms attested in the data.

(4) Consonant harmony in English (data from Smith 1973: 212-262 and Pater & Werle 2003: 385)

Harmony Type	Word	Target IPA	Child's Production	Word Shape	Directionality
NO Harmony	book	[buk]	[b̥uk]	CVC	
	bite	[bait]	[b̥ait]	CVC	
Dorsal	duck	[dʌk]	[gʌk]	CVC	regressive
	cloth	[klɑθ]	[g̊ɔk]	CVC	progressive
	cup	[kʌp]	[kʌk]	CVC	progressive
	pickle	[pɪkəl]	[gɪgʊ]	CVCV	regressive
	doggie	[dɔgiː]	[gɔgiː]	CVCV	regressive
	glasses	[glæsɪz]	[gægɪ]	CVCV	progressive
Labial	stop	[stɑp]	[bɔp]	CVC	regressive
	thump	[θʌmp]	[wʌp]	CVC	regressive
	table	[teɪbəl]	[beːbu]	CVCV	regressive
	thimble	[θɪmbəl]	[wimbu]	CVCV	regressive

In English CVC words like 'duck', for example, the velarity of word-final /k/ regressively assimilates the coronality of word-initial /d/. The same process occurs in CVCV words like 'doggie' where, for example, the velarity of /g/ assimilates the coronality of word-initial /d/. There is also progressive assimilation where the velarity of the word-initial /k/ of /klɒθ/ assimilates the coronality of word-final /θ/. In the examples of labial harmony, only regressive assimilation processes occurs. The labiality of the word-final /p/ in /stɑp/ assimilates word-initial /t/. (The word-initial sC cluster is reduced to a stop through an independent process.) The same processes occur in CVCV words.

2.1 Linear Phonology and Rules

Within the rule-based framework of Linear Generative Phonology used by Smith (1973), it is relatively difficult to analyze this process of assimilation of consonants

across an intervening vowel. A method for looking at non-local relations is required. Smith (1973) proposed the following rules to account for consonant harmony.

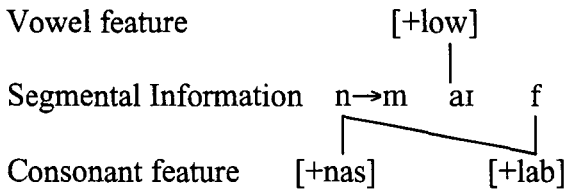
(5) Rules of consonant harmony (Smith 1973: 165)
a) Velarizing coronal continuants after a velar
b) Velarizing or labializing coronals before a velar or labial

The problem with these rules is that they merely describe the phenomenon instead of providing an explanation for it. However, since Smith's study, several attempts have been made to explain consonant harmony in individual languages, as outlined in the subsequent sections.

2.2 Non-Linear Phonology and Underspecification Theory

A two-part account of consonant harmony was developed within the framework of Feature Geometry, using articulator-based models of segmental representation (e.g. Sagey 1986). Addressing the problem of the non-adjacency of consonants noted by Smith (1973), Spencer (1986) proposes first that there is planar segregation between consonants and vowels such that these two types of segments are represented on separate planes, to avoid crossing association lines and allow spreading of features between segments, as depicted in (6) (see also Macken 1992, McDonough and Myers 1991 and Stemberger and Stoel-Gammon 1991).

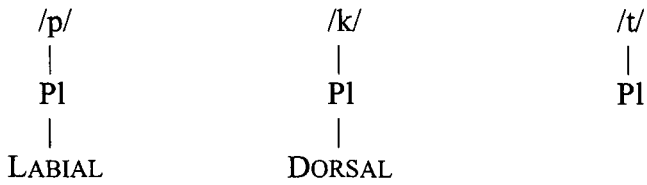
(6)



Adapted from Goad (1996: 187)

Second, Spencer (1986) proposes that coronal underspecification (see, e.g. contributions to Paradis and Prunet 1991) is the reason behind the fact that coronals are often the targets of consonant harmony. Underspecified coronals lack the feature [CORONAL] in their representations, as illustrated in (7), which makes them prime targets to consonant harmony.

(7)



As pointed out by Goad (1997) and Rose (2000), both components of this approach are problematic. First, there are no independent arguments in child language for planar segregation, which has been primarily argued for in the analysis of nonconcatenative languages such as Arabic, where discontinuous morphemes are attested (McCarthy, 1981). Child language, however, presents no evidence for a formal disconnection between consonants and vowels as mentioned by Goad (1996). Second, as predicted by coronal underspecification, surface coronal consonants devoid of an underlying Coronal feature should not target other segments for consonant harmony.

However, there exist data in which coronals *do* trigger consonant harmony (see example (3) and Goad 1997 for discussion).

2.3 Optimality-theoretic Accounts of English Consonant Harmony

The original version of Optimality Theory was proposed by Prince and Smolensky (1993) to account for well-formedness relations observed in output forms. McCarthy and Prince (1995) shifted the focus of OT and developed a framework to account for formal relations between input and output forms called Correspondence Theory. Both of these frameworks assume the basic tenet of OT that the grammar consists of a universal set of innate, freely-rankable and violable constraints. Language variation, as well as the various stages of acquisition observed in child language, can be accounted for by different rankings of these constraints. Within OT, two distinct analyses of consonant harmony are proposed and discussed. An "Alignment" approach is proposed by Goad (1997), and a "Repeat" approach is proposed by Pater (1997) to account for consonant harmony in English learning children.

2.3.1 "Alignment"

Goad (1997) proposes that children are able to perceive many more contrasts than they can produce, because the early rankings of phonological constraints limit their productions. The analysis she proposes includes the constraints PARSE AND ALIGN, defined in (8) and (9), respectively.

(8) PARSE: Elements in the underlying forms must be parsed in surface forms.

(9) ALIGN: Some element from the underlying form is aligned with the left edge of the articulator domain.

Goad (1997) states that English children often target coronals because of the constraint ranking illustrated in (10), in which constraints within curly brackets are unranked with respect to each other.

(10) {PARSELAB, PARSEDOR}>>{ALIGNLAB, ALIGNDOR}>>{PARSECOR}>>{ALIGNCOR}

(Adapted from Goad 1996: 195)

Input: dʌk		PARSE LAB	PARSE DOR	ALIGN LAB	ALIGN DOR	PARSE COR	ALIGN COR
	a) dʌk				*!		
	b) dʌt		*!				
➔	c) gʌk					*	

According to the above constraint ranking, Candidate c), the output candidate displaying velar harmony, is selected as optimal because it only violates the lowly-ranked constraint PARSE CORONAL; higher-ranked constraints are violated by each of the other candidates: Candidate b), which shows deletion of the dorsal feature, violates the highly-ranked PARSE DORSAL constraint while Candidate a), which fails to display velar harmony, violates the ALIGN DORSAL constraint.

Goad (1996) proposes that, in order to reach the adult stage, in which consonant harmony is not attested, these constraints must be reordered. One potential problem with

this analysis, if used to account for cross-linguistic data, is that it does not take domain effects into consideration. As Rose (2000) argues, while this does not pose a problem with regard to the English data, this problem becomes evident through a look at French data, as we will see in section 3.3

2.3.2 "Repeat"

The "Repeat" approach, the essence of which was initially proposed by Pater (1996, 1997), incorporates the constraint REPEAT, which accounts for the preference for repeated gestures in the linguistic productions of children.

(11) REPEAT: successive consonants must agree in place specification.

In the grammar of children displaying consonant harmony, the REPEAT constraint outranks FAITHFULNESS constraints. Within the FAITHFULNESS constraints FAITHDORSAL and FAITHLABIAL are ranked more highly than FAITHCORONAL.

(12) {REPEAT}>> {FAITHDOR}>> {FAITHLAB}>>{FAITHCOR} (Pater 1997: 236)

Input: dɑg	REPEAT	FAITHDOR	FAITHLAB	FAITHCOR
a) dɔg	*!			
b) dɔd		*!		
➔ c) gɔg				*

According to the above constraint ranking, candidate c), the output candidate displaying velar harmony, is selected as optimal because it violates a lowly-ranked

constraint only. The other candidates violate constraints that are ranked higher. Candidate a), which shows an adult like form of the word that does not repeat any given place of articulation, violates the highly ranked REPEAT constraint. Candidate b), which shows a repeated coronal place of articulation, violates the FAITH DORSAL constraint.

Similar to the analysis by Goad, this analysis accounts for the English data without any need to make reference to prosodic domains. It simply predicts the repetition of a given gesture throughout an entire word. As alluded to above, however, repeated gestures will appear only within a given domain in the French data. In addition, the analysis does not predict directionality for consonant harmony. (For a more recent account of directionality see Pater and Werle 2003). Finally, Pater (1996) suggests that the REPEAT constraint must disappear in order to produce adult-like forms. This also poses a theoretical problem because, within standard approaches to OT, constraints cannot be added to, or removed from, the grammar.

2.4 Interim Summary

The literature on consonant harmony in English-learning children thus provides evidence that consonant harmony occurs in both CVC and CVCV words, most commonly with dorsal and labial consonants acting as triggers and coronals acting as the target undergoing the assimilation. As we will see in the next sections, however, other languages contradict this generalization, thereby posing additional problems for the accounts discussed above.

3. Patterns of Consonant Harmony in French

In the data from one French-learning child documented in Rose (2000) and Rose and dos Santos (to appear), there is evidence for differences in the behaviors of words with different shapes. As exemplified in (10), consonant harmony is attested in CVCV words. In CVC words, however, we observe non-harmonized forms in addition to some cases of place feature metathesis.

(13) Consonant harmony and metathesis in French: CVC vs. CVCV word shapes (Rose 2000: 171-173; Rose and dos Santos to appear: 12)

Harmony Type	Word	Target IPA	Child's Production	Word Shape	Directionality	Gloss
No Harmony	goutte	[gʊt]	[gʊt]	CVC		(a) drop
	dame	[dam]	[dam]	CVC		lady
Metathesis	sac	[sak]	[katʃ]	CVC		bag
	tigre	[tsɪg]	[kɪːn]	CVC		tiger
Dorsal	du caca	[dyka'ka]	[geke'ka]	CVCV	regressive	some poop
	dragon	[dʁa'gɔ̃]	[gɛ'gɔ̃]	CVCV	regressive	dragon
Coronal	couleur	[kulœʁ]	[tʊlœʷ]	CVCV	regressive	(a) color
	gâteau	[gɑto]	[tæto]	CVCV	regressive	cake
Labial	capable	[kapab]	[pæpæb]	CVCV	regressive	capable
	Gaspard	[gaspɑʁ]	[bapæː]	CVCV	regressive	Gaspard

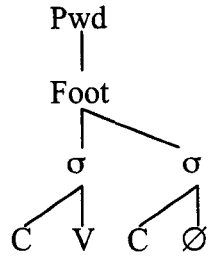
Focusing on CVC words, we can see that in the target form of the word "goutte" [gʊt], adult-like consonants /g/ and /t/ are produced by the child. As opposed to this, the initial coronal consonant /s/ and the final velar consonant /k/ of the word sac /sak/ 'bag' are reversed in order and produced by the child as [katʃ]. All of these forms contrast with the input CVCV forms presenting similar sequences of articulators, which do display consonant harmony. Furthermore, unlike the English examples previously discussed, we

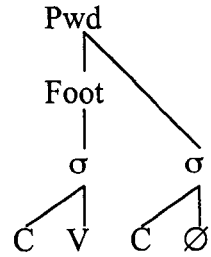
find cases of coronal harmony in addition to labial harmony. In the word "gâteau" /gɑto/, the coronality of the /t/ assimilates the velarity of the /g/ producing the form [tæto]. Labial harmony can be observed in the word "capable" /kapab/ where the labiality of the word medial /p/ harmonizes the dorsality of the work initial /k/ producing a form [pæpæb].

3.1 Prosodic Licensing: Optimality-theoretic Account of French Consonant Harmony and Metathesis

In order to account for the French data, Rose (2000) proposed an OT-based analysis of consonant harmony and metathesis. As seen above, and unlike what was observed in the English data, there exist differences in the production strategies affecting French CVC versus CVCV words. Assuming that word-final consonants are syllabified by the child as onsets of empty-headed syllables (e.g. Goad and Brannen 2003, Piggott 2000), Rose (2000) argues that differences observed between English and French can be accounted for through the differences in foot structure between the two languages. As illustrated in (14a), in English, the final consonant in a CVC word is part of the foot. In (14b) we see that in French, the final consonant in a CVC word is extra-prosodic i.e. outside of the foot domain.

(14) a) English (trochaic) CVC∅ b) French (iambic) CVC∅





According to Rose (2000), an analysis relying on the notion of prosodic licensing, making direct reference to both consonants' place of articulations and to formal aspects of prosodic constituency, combined with variable rankings of place feature faithfulness constraints, are central to the characterization of consonant harmony. Rose posits licensing relations as proposed by Itô (1986) on the realizations of the place features in the head of some prosodic constituent, in this case the foot. The foot licensing and Max constraints utilized by Rose (2000) are as follows:

(15) LIC(X, Ft): X must be licensed by the head of the foot; where X may be Labial, Coronal or Dorsal.

(16) MAX(X): every input feature X has an output correspondent; where X may be Labial, Coronal, or Dorsal.

The interaction of these constraints is illustrated in (17) with the account of the coronal harmony pattern observed in the data.

(17) Prosodic licensing in French consonant harmony (Rose 2000: 209)

Input: gɑto	MAX(Lab)	LIC (Dor,Ft)	LIC (Cor, Ft)	MAX(Cor)	MAX(Dor)	LIC (Lab, Ft)
a) gæto		*!				
b) gæko				*!		
➔ c) dæto					*	

According to the above constraint ranking, candidate c), the output candidate showing coronal harmony, is selected as optimal because it only violates the lowly-ranked MAX(Dorsal) constraint. The other candidates violate higher-ranked constraints. Candidate a), which represents an adult like form, violates the highly-ranked LICENSE(Dorsal, Foot) constraint. Candidate b) displays velar harmony, which violates the MAX(Coronal) constraint.

Rose (2000) proposes that consonant harmony is present when the child's grammar gives precedence to the LICENSE constraints and consonant harmony does not appear (i.e. here CVC forms) when the child's grammar favors the MAX constraints. Finally, Rose (2000) demonstrates that his analysis can be applied equally well to English data from the works of Smith (1973) and Pater (1996).

One potential problem with this analysis is pointed out by Brulard and Carr (2002), who state that there is no single prosodic feature which can drive consonant harmony for all children cross-linguistically. These authors claim that consonant harmony may arise from a series of different factors such as syllable or word shape,

repertoire, templates, and selection of target word. Their claim receives additional support below.

3.2 Interim discussion

As I alluded to above, the analyses based on evidence from English fail to account for the French data. First of all, there are several examples in Rose (2000) where coronals trigger consonant harmony affecting velars (see examples of coronal harmony in (13)). This contradicts all approaches based on coronal underspecification, since consonants without place features cannot trigger consonant harmony.

In addition, analyses based solely on constraints (the Align and the Repeat analyses) are problematic with regard to the French data. Indeed, these analyses make no reference to word shape effects. In the underspecification analysis the primary cause of harmony is the lack of coronal feature, which would apply regardless of prosodic domain. Note however that in the OT-based approaches of Goad (1997) and Pater (1996), constraints could likely be adapted to make similar references to formal aspects of prosodic constituency as those proposed by Rose (2000). Finally, and most importantly in the context of this thesis, none of the analyses discussed thus far can account for the evidence observed in Dutch-learning children, to which we turn in the next section.

4. Patterns of Consonant Harmony in Dutch

As we will see in this section, Levelt (1993, 1994, 1996) and Fikkert and Levelt (2004, 2006) examine the Dutch data in a way that clearly departs from the spirits of the

analyses reviewed thus far. First, in (18), we can observe some examples representative of the Dutch data, which Levelt (1993, 1994) labels as 'apparent' cases of consonant harmony.

(18) Apparent Dutch consonant harmony (Levelt 1993: 41-44)

Harmony Type	Word	Target Form	Child's output	Word Shape	Directionality	Gloss
Labial	*poes*	[pus]	[puf]	CVC	progressive	cat
	boek	[buk]	[pup]	CVC	regressive	book
Coronal	*muts*	[mʉts]	[tyts]	CVC	regressive	cap
	vis	[vɪs]	[sɪs]	CVC	regressive	fish
Dorsal	*vogel*	[voχəl]	[χoχo]	CVCV	regressive	bird
	pelikaan	[pelikan]	[kaŋ]	CVC	progressive	pelican

In (18), we can see examples of 'apparent' labial, coronal and velar harmony. In the word 'poes' the word final coronal consonant /s/ assimilates to the labiality of the word initial /p/ producing the form [puf]. In the word 'vis' the word initial labial consonant /v/ assimilates to the coronality of the word final /s/ producing the form [sɪs]. Finally, in the word 'vogel' the word initial labial consonant /v/ is assimilated to the dorsality of the word medial consonant /χ/ producing the form [χoχo].

4.1 Partial Lexical Specification

Levelt (1993, 1994, 1996) and Fikkert and Levelt (2004, 2006) observe frequently-occuring interactions between consonants and vowels in the early productions of Dutch learners. They propose that the apparent interactions between consonants and

vowels come from a partial specification[2] of lexical items in the developing lexicon. That is, the feature sharing effects observed in the forms comes from an incomplete featural representation of early lexical entries. For example, they argue that a [Cor+i+Cor] word is represented with a unique place feature, Coronal (see (19) below). Harmony in this and similar cases, therefore, does not result from an interaction between non-adjacent consonants. It follows from their argument that the process labeled as consonant harmony can in fact be an epiphenomenon of partial (incomplete) feature specification in words which yields an apparent interaction between adjacent consonants and vowels. This proposal was originally developed by Levelt (1993, 1994, 1996), and was subsequently expanded by Fikkert and Levelt (2004, 2006). According to Fikkert and Levelt (2006), the word *prik*, could be lexically represented as shown in (19).

(19) Incomplete lexical representation (Fikkert and Levelt 2006: 19)

prik (injection)

Adult output:	[prɪk]
Child's lexical representation:	C I C
	Cor
Typical Production:	[tɪt]

As we can see in (19), the word is represented as a CVC string associated with a single place feature. This configuration yields a coronal-harmonized form in the child's output.

[2] Partial specification has a much larger scope than that of the idea discussed here, where it is used to refer to the projection of a single place of articulation onto the prosodic word.

For the purpose of investigating the apparent C-V identity, Levelt (1994) assumes that [–back] vowels are coronal, [+back] vowels are dorsal, and that [+round] vowels are labial. Additional examples of the effects of the sharing of these features are provided in (20) below.

(20) C-V identity: additional examples (Levelt 1996: 237)

Shared Feature	Word	Target Form	Child's output	Word Shape	Directionality	Gloss
Dorsal	poes	[pus]	[kus]	CVC	regressive	cat
	potlood	[pɔt,lot]	[bɔk,hoʊ̯t]	CVC	progressive	pencil
Coronal	kip	[kɪp]	[tɪp]	CVC	regressive	chicken
	kijk	[kɛik]	[kɛt]	CVC	progressive	look
Labial	hond	[hɔnt]	[hɔf]	CVC	progressive	dog
	doen	[dun]	[dum]	CVC	progressive	do

According to Levelt's analysis of some examples in (20), the /p/ of /pus/ assimilates to the dorsality of the /u/ and becomes [kus]. The /k/ of /kɪp/ similarly assimilates to the coronality of the /ɪ/ producing the form [tɪp]. Finally, the /n/ of /dun/ assimilates to the labiality of the /u/ producing the form [dum]. Notice that given the system of features used by Levelt, the exact same vowels may accommodate harmony based on different places of articulation. For example /u/ may share its dorsal feature [+back] (/pus/ → [kus]) or its labial feature [+round] (/dun/ → [dum]) with a consonant.

This analysis, however, is problematic, primarily because it cannot apply to the English and French data discussed in sections 3.1 and 3.3. First, as Rose (2000) shows, consonant harmony in these languages applies across vowels that do not necessarily share the harmonizing feature, as exemplified in (21).

(21) Consonant harmony without C-V identity (Rose 2000: 221)

Harmony Type	Word	Target form	Child's output	Language	Gloss
Dorsal	big	[bɪg]	[gɪg]	English	big
Labial	chapeau	[ʃapo]	[pæpo]	French	hat
Coronal	couleur	[kulœʁ]	[tʊlœʷ]	French	color

In the data presented in (21) there is velar harmony where the intervening vowel is a front (coronal) vowel, labial harmony where the intervening vowel is a low central vowel, and coronal harmony where the intervening vowel is a back rounded vowel, which may be considered dorsal and/or labial but certainly not coronal. In these examples, it is not the case that consonant place feature assimilation is an epiphenomenon of partial specification which results in C-V identity.

Second, there are very few quantitative data presented in Levelt (1993, 1994, 1996) and Fikkert and Levelt (2004, 2006). This prevents a full assessment of the representativity of the proposal and of the variability within the data.

Finally, while Levelt (1993, 1994, 1996) and Fikkert and Levelt (2004, 2006) address aspects of the phonological properties of the target forms attempted by the children, most of their focus is on the actual productions. In addition, their focus on place of articulation tackles the core of the question; however, information about manner of articulation is not addressed. Literature on consonant harmony reveals that manner may play a role in the realization of consonant harmony, as was seen in the examples in (1) through (3) at the beginning of this chapter.

5. Discussion

In most child languages, consonant harmony occurs between primary place of articulations. However, patterns of child consonant harmony appear to differ across languages. English, French and Dutch consonant harmony have been analyzed in sometimes radically different ways. None of the accounts proposed can encompass all three of the languages as they have been documented thus far. The analyses discussed above in fact suggest that there exist different driving forces behind consonant harmony cross-linguistically.

Rose (2000) pointed out that differences between English and French data can be prosodically motivated. One would expect Dutch to behave similarly to English because both languages are similar in their prosodic structure. However, the Dutch data are compiled in such a way that may make them appear to be at odds with the English and French data. The English, French and Dutch data would have to be compiled in such a way that makes them comparable in order to draw cross-linguistic generalizations.

Because only a portion of the Dutch data is reported in the literature, these data must be recompiled and, whenever relevant, be reanalyzed based on the new compilation. In order to take into consideration factors such as feature co-occurrence restrictions or positional effects, this analysis should also include an examination of aspects such as the shape of target forms and factors related to manner of articulation. Finally, quantitative data must be provided, in order to assess the representativity of the patterns found. These observations constitute the starting point of the current investigation.

6. Methodology

In order to address these issues, I looked at individual case studies of two of the children (Jarmo and Eva) whose productions were examined in the original study of consonant harmony in Dutch by Levelt (1994). The longitudinal, developmental data were obtained by Fikkert and Levelt during recording sessions every other week for a period of approximately one year. During this time Jarmo ranged in age from 1;04.18 to 2;04.01, and Eva ranged from 1;04.12 to 1;11.08. My investigation was primarily data-oriented and required a complete recompilation of these children's data and a subsequent reanalysis based on the new compilations. This corpus of Dutch-learning children is available publicly on the *CHILDES* website (http://childes.psy.cmu.edu/). The data was extracted from the *CHILDES* database and compiled into a *NeoOffice 1.2* (*OpenOffice*) spreadsheet. This method allowed visual comparisons and data sorting via several criteria. These criteria included the record number; the child's age; orthography; IPA trigger and IPA target; word shape; production strategies which are present; and notes. I looked at the data from from both qualitative and quantitative perspectives in order to provide a representative account of production strategies emerging in the children's outputs. Recompilation of the Dutch data was performed in a way such that these data could be systematically compared with the English and French data available in the literature.

Patterns of apparent consonant harmony observed constitute the starting point of the study. First, I addressed each of the cases of apparent consonant harmony from the perspective of the place of articulation of the consonants targeted by the harmonizing

processes. All the words in these utterances were coded for their place of articulation structure in the following way: labial consonants were represented by P, coronal consonants by T, and dorsal consonants by K. Back rounded (labial) vowels were represented by U, front (coronal) rounded and unrounded vowels by I, and back unrounded and low (dorsal) vowels by A. I then examined all attempted cases of these targeted segments, in order to determine the extent to which the production strategies yielding harmony could affect these consonants, even in output forms that did not display harmony. At each step of this investigation, quantitative data were also collected in order to report on the representativity of the qualitative assessments. In other words, I characterized each production strategy identified from the perspective of the types of consonants it targeted, and characterized each target consonant type from the perspective of the production strategies affecting it. Each production strategy was then analyzed as being an inherently harmonizing process or as being a harmonizing process by accident, due to other independent factors involved. Finally, throughout the investigation, I discussed the proportion of the forms showing C-V identity, keeping in mind a potential role for partial specification, under the expectation that it should manifest itself in early word productions. As we will see, some of the patterns of apparent consonant harmony extend well beyond what should be considered an initial stage of partial lexical specification, thereby posing a challenge to Fikkert and Levelt's hypothesis. In Chapters 3 and 4, details will be provided about developmental stages wherever necessary.

The method of recompilation in this investigation allowed systematic characterizations of similarities and differences in apparent patterns of consonant

harmony, thereby setting the first steps toward a formal typology of consonant harmony in child language based on a unified data compilation. This was especially necessary since the English and French data discussed in depth in Rose 2000 and Pater and Werle 2003, are already compiled in a similar way.

Chapter 3 - Jarmo: A Case Study

1. Introduction

In this chapter, I discuss the patterns found in Jarmo's data that result in consonant-harmonized forms. As we will see, these harmonized forms emerge from a number of independent processes, all of which shed light on aspects of the child's developing phonological system. I first provide a general picture of the apparent cases of consonant harmony and later provide a more detailed characterization of the factors conditioning these harmonized cases.

The chapter is organized as follows. In section 2, I provide a general classification of apparent cases of harmony, breaking down these cases into each consonantal and vocalic context involved. In section 3, I provide a more in-depth discussion of each general pattern of harmony, focusing primarily on the consonants that are targeted by the harmonizing processes. Shifting the focus on these harmonizing processes, I discuss, in Section 4, how each of them results in, or contributes to the labial-, coronal- and dorsal-harmonized forms found in the corpus. Finally, in section 5, I conclude the chapter by summarizing the main observations made throughout the chapter.

2. Apparent Cases of CH in Jarmo's Productions: An Overview

In this section, I provide a general overview of the apparent cases of CH found in Jarmo's productions. Note that this classification, whose primary goal is not to test or replicate the studies by Levelt (1993, 1994, 1997) and Fikkert and Levelt (2004, 2006)

but rather to provide a starting point for the general discussion, is performed irrespective of age or developmental stages. (Recall that the hypothesis of partial specification laid out in the relevant works by Levelt and Fikkert focuses primarily on early developmental stages.) The table in (1) provides the general distribution of the harmonized forms in the corpus where a single letter represents the place of articulation of the corresponding consonant or vowel.

(1) Distribution of Apparent CH

a. Apparent labial harmony	64	
PIP	7	11%
PAP	18	28%
PUP	39	61%
b. Apparent coronal harmony	147	
TIT	112	68%
TAT	25	17%
TUT	10	7%
c. Apparent dorsal harmony	48	
DID	7	15%
DAD	21	44%
DUD	20	42%
Total cases of apparent consonant harmony	237	

On the face of it, no immediate generalizations can be made. However, the cases of apparent CH presented in (1) appear to be unevenly distributed across vowels. For example, there are 112 cases of apparent coronal harmony in the environment of a front vowel, which accounts for 68% of the coronal-harmonized data. Such cases would be predicted under any explanation allowing for place feature sharing between consonants and vowels. However, I will demonstrate later that the relation between coronal

consonants and front vowels suggested by these examples actually arises from an independent process of segmental substitution targeting labial continuants which, coincidentally, is attested with a high number of words in which the vowel adjacent to the substituted consonant is front (coronal). The basic source of the coronal harmony process thus relates to the fate of labial continuants which, as we will see, are generally problematic in Jarmo's productions.

Observations such as these will be made in the next section, where each of the apparent harmony cases is broken down in a way that will enable the identification of the causes underlying the harmonized forms produced by Jarmo.

3. Apparent Cases of CH: A Closer Look

In this section, I address each pattern of harmony from the perspective of the consonants targeted by the substitutions. As we will see, this novel perspective on the Dutch data will uncover a series of production strategies which, when combined, provide a strong predictor for the harmonies observed. For the sake of clarity, I provide a breakdown of the affected manners of articulation for each major place of articulation that acts as a substitute in the data. I begin with the table in (2), which provides a breakdown of the affected consonants that result in apparent labial harmony.

(2) Apparent labial harmony

Number of cases	64		
Affecting coronals 56	[l]	38	59%
	Stops	15	23%
	Continuants	3	5%
Affecting velars 7	Stops	4	6%
	Continuants	3	5%
Other 1		1	2%

Out of the 64 cases of apparent labial harmony found, 38 (59%) affect the coronal lateral [l]. However, the apparent prominence of this pattern can for the most part be explained by the high frequency of some target forms in the data. Specifically, of the 38 cases where [l] becomes a labial, 14 originate from the target word *Paula* ['paula] produced as [ˌpɑu'ʊa], nine from the target word *bal* ['bɑl] which surfaces as ['bɑʊ], and four examples where ['ɑpəl] is realized as ['ʔɑpɔw]. Some examples from the 11 remaining cases of labial harmony are provided in (3).

(3) Labial harmony affecting laterals[3]

Ortho	**IPA Target**	**IPA Actual**	**Age**
slapen	['slapə]	['papə]	01;10.23
kameel	[ˌka'mel]	['meuw]	02;03.09
bellen	['bɛlən]	['bɑʊə]	02;02.06
lepel	['lepəl]	['depow]	02;02.06
schommel	['sχɔməl]	['homow]	02;02.06

As these examples suggest, labial harmony can target laterals in a variety of phonological contexts. More generally, we must keep in mind, as mentioned above, that few other

[3] All examples provided will be presented in tables with this same format but will avoid column headers.

types of coronals or consonants with other places of articulation are targeted by labial assimilation.

Turning now to cases of apparent coronal harmony, we can observe in (4) that the vast majority of the cases found affect target labial segments (110 out of 147; 75%).

(4) Apparent coronal harmony

Number of cases	147		
Affecting labials 110	Continuants	71	48%
	Stops	39	27%
Affecting velars 36	Continuants	22	15%
	Stops	14	10%
Other 1		1	1%

A closer look at the compilation in (4) reveals that approximately half (48%) of the apparent cases of coronal harmony affect labial continuants. An additional 39 cases (27%) affect labial stops. As opposed to these, velar consonants seem to be more marginally targeted by the harmonizing process (25% in total).[4] Similar to the apparent cases of labial harmony, we observe here again that the harmonizing process mostly targets a specific natural class, this time, that of labial continuants.

Finally, I provide a breakdown of the apparent cases of dorsal harmony in (5).

[4] The difference between the respective contributions of labial versus velar consonants to cases of coronal harmony may in fact be an artifact of frequency in Dutch. Indeed, as reported by van de Weijer (1998), labial consonants occur almost twice as frequently as velar consonants in the language (22% versus 12%).

(5) Apparent dorsal harmony

Number of cases	48		
Affecting labials 20	Stops	12	25%
	Continuants	8	17%
Affecting coronals 28	Stops	21	44%
	Continuants	7	15%

Again here, we can see that harmony arises from consonants with a specific manner of articulation for the most part, that of stops, leaving continuants largely untouched, except for a few cases which appear to be marginal.

From the breakdowns presented in (2), (4), and (5), we can see that each type of harmony results from production strategies affecting special types of targets. I now move to a discussion of these patterns resulting in consonant harmony, this time focusing on the consonants' places of articulation.

4. Production Strategies Resulting in Apparent Consonant Harmony

In this section, I characterize in further detail the sources of the apparent cases of consonant harmony through discussing the behavior of each of the segments identified as targets in the preceding section. It is from this investigation that some of the causes underlying the harmony patterns identified above will emerge. Beginning with labial consonants, which are targeted mostly by production strategies resulting in coronal harmony in (4), I examine first their behavior in onset position.

4.1 Production Strategies Affecting Labials

In this section, I will describe in more detail the behavior of labial consonants. This discussion will focus on labials in onsets only. This focus is determined by the fact that labials in codas are in fact rare in Dutch. Indeed, as reported by van de Weijer (1998), labials account for only about 12% of all codas in Dutch. Because of this, only a few attempts at labials in codas can be found in Jarmo's data. No conclusion can be drawn from these data. However, I do discuss these data in section 6.2, in relation to the behavior of labials in onsets.

As we can see in (6), 828 labials are attempted in onsets in the data collected from Jarmo. Of these 828 cases, 599 are labial stops [p, b, m]; the other 229 cases are labial continuants [f, v, ʋ, w].

(6) Distribution of labial onsets in Jarmo's attempted forms

Attempted labial onsets 828	
Labial stops 599	Labial continuants 229

I first discuss the behavior of the labial stops in the next section. As we will see, these consonants are generally produced in a target-like fashion by Jarmo, except during a small period of time when they appear to undergo a process of coronal harmony.

4.1.1 Labial Stops in Onsets

Labial stops in Jarmo's onsets are generally unproblematic. This can be seen from the breakdown provided in (7).

(7) Behavior of labial stops in Jarmo's onsets

Attempted forms	599	
Target-like	480	80%
Coronal harmony	30	5%
Coronal substitution	16	3%
Dorsal substitutions	18	3%
Other	55	9%

Out of the 599 labial stops attempted in onsets, 480 (80%) are produced as target-like. Of these 480 target-like forms, 400 appear on or after age 1;09.09 (in the last seven months of the corpus). The table in (8) provides some representative examples of Jarmo's target-like productions of labial stops. I do not concern myself here with issues that pertain to voicing distinctions.

(8) Target-like labial stop onsets

bedje	[ˈbɛt͡jə]	[ˈpɛʃë]	02;02.27
schildpad	[ˈsχɪl̩pɑt]	[ʔəˈpaət]	01;11.20
Paula	[ˈpɑula]	[ˌpɑuˈʊa]	02;00.04
bad	[ˈbɑt]	[ˈbɑp]	01;09.23
poesjes	[ˈpuʃəs]	[ˈpuʃʉs]	02;03.09
boek	[ˈbuk]	[ˈbuk]	02;03.09
bootje water	[ˈbot͡jə ˈʋatəɪ]	[ˈboːʃə ˈlatə]	02;03.09

Another pattern is that of coronal substitution affecting 16 labial stops in onsets. These substitutions are attested between the relatively late ages of 1;10.23 and 2;03.09. These cases result in eight of the 64 cases (13%) of coronal-harmonized forms. Of these eight cases of apparent coronal harmony, six (75%) display C-V identity.

In contrast to these, many of the other labial stops that are not produced as target-like are found in Jarmo's earlier recorded examples. From these other non-target-like

data, no clear tendency could be identified, except for one related to a process of coronal harmony. 30 (5%) of the attempted labial stops in onsets display this pattern. While this number may appear at first glance to be insignificant, a concentration of these examples is found during a relatively short time interval, which appears to result from a true process of consonant harmony. I discuss these examples further in section 5.

In the following section, I discuss the fate of labial continuants in onsets. As we saw in (4), a large number of these consonants are found in target forms that are produced as coronal-harmonized. Taking this as a starting point, I demonstrate that these examples in fact result from a process of coronal substitution. Extending my data coverage to all target labial continuants, I also discuss additional patterns affecting these consonants.

4.1.2 Labial Continuants in Onsets

In this section, I discuss the behavior of labial continuants. I demonstrate that these consonants are affected by a general production problem, which results in two main production strategies, namely coronal substitution and consonant debuccalization. Coronal substitution is defined here as a process of segmental substitution which occurs independently of the presence or not of another coronal consonant in the word or of the phonetic make-up of the vowel adjacent to the substituted consonant. Consonant debuccalization is defined as the process by which a consonant loses its supralaryngeal articulator and is realized as the laryngeal /h/ or /ʔ/ (Clements: 1985). The table in (9) provides a breakdown of coping strategies used by the child for target words with a labial continuants in onsets.

(9) Distribution of labial continuants in onsets

Attempted forms	229	
Target-like	44	19%
Coronal substitution	98	43%
Debuccalization	34	15%
Stopping	22	10%
Velar substitution	11	5%
Other	19	8%

Out of the 229 attempted words with a labial continuant in onset position, only 44 (19%) of are realized as target-like. Of these 44 target-like forms 42 (95%) appear on or after the age of 1;09.09 (i.e. during the last seven months of recorded data). The table in (10) provides examples of Jarmo's target-like productions of labial continuants.

(10) Target-like productions of labial continuants in onset

fiets	['fits]	['f̬i̬s̬]	01;09.23
vogel	['voχəl]	['foχo]	01;10.23
Willy	['ʊɪli]	['ʊ̬li]	01;11.06
visjes	['vɪʃəs]	['fɪs͡jɪs̬]	02;00.04
varkens	['varkəns]	['fak͡jəs]	02;00.28
vasthouden	['vast̬haudə]	['fast̬hauʊə]	02;01.08
vinger	['vɪŋər]	['fɪŋä]	02;02.27
weg	['ʊɛχ]	['ʊɛχ]	02;03.09

In 98 of the 229 attempted forms (43%), a coronal is substituted in place of the labial continuant. The table in (11) provides representative examples of coronal substitution.

(11) Coronal substitution of labial continuants in onset

vis	['vɪs]	['s̪iʃ̺]	01;09.09
fiets	['fits]	['tɪt]	02;00.28
vinger	['vɪŋər]	['sɪŋə]	02;03.09
weg	['ʊɛχ]	['lɛχ]	02;03.09
olifant	['oli̪fɑnt]	['totɑut]	02;01.22
gevallen	[χə'vɑlən]	['sɑ̟lɯ]	02;04.01
vos	['vɔs]	[sɔ'ʔɔs]	02;03.09
bootje water	['bo͡tjə 'ʋatəɪ]	['boːʃə 'latə]	02;03.09
dit is vogel	['dɪt 'ɪs 'voχəl]	['fɪs 'toχɔ]	02;00.04

This data sample appears to partially support the hypothesis that the coronal substitutions observed in Jarmo's data come from partial specification. Out of the 98 cases of coronal substitutions affecting labial continuants, 69 result in coronal-harmonized forms, which account for 47% of the 147 cases of apparent coronal harmony attested in the corpus. 54 of these 69 coronal-harmonized forms display C-V identity. However, it must also be noted that 25 of these cases can be attributed to a single word, *Willy* [wili] which is generally realized as [lili]. While there is still a relatively high proportion of examples showing C-V identity even after these examples are excluded from consideration, the trend observed in these data loses much of its significance when one considers the fate of other labial continuants in onsets that do not undergo coronal substitution.

Indeed, in addition to coronal substitution, debuccalization also emerges as a prominent production strategy for labial continuant onsets in 34 (15%) of the 229 attempted forms. The table in (12) illustrates representative examples of this production strategy.

(12) Debuccalization of labial continuants in onset

televisie	[ˌtelə'visi]	[ˌse'hisi]	02;03.09
wipwap	['ʊɪpˌʊɑp]	['hɪp/la]	02;01.08
visje	['vɪʃə]	['ʔisi͡ʃə]	01;09.09
weg	['ʊɛχ]	['ʔɛχ]	02;00.04
willy	['ʊɪli]	['hili]	01;10.09
fiets	['fits]	['ʔiʃ̺]	01;09.23
wassen	['ʊɑsən]	['hɑs̪ʉ]	02;00.04
vogel	['voχəl]	['hoχo͡ŭ]	01;10.23
vogel	['voχəl]	['ʔoχo]	02;00.28
tafel	['tafəl]	['tahɔ]	01;10.23

It is evident from these examples that debuccalization occurs regardless of the quality of the adjacent vowel. As we can see, this strategy occurs as much with front vowels as with other types of vowels. We can deduce from this observation that both coronal substitution and debuccalization are used as production strategies to avoid labial continuants. Also, the fact that coronal substitution appears as the most prominent pronunciation strategy raises the issue as to why coronals behave as a default consonant in Jarmo's phonology. I will return to this issue in chapter 5.

Since the labial stops attempted by Jarmo are largely unproblematic (save the process of coronal harmony noted in section 4.1.1 above and further discussed in section 5 below), I attribute the patterns illustrated in (11) and (12) to the continuancy of the labials attempted by Jarmo. This hypothesis is further supported by another coping strategy used by the child, that of stopping. Albeit appearing less frequently, this production strategy is still found in 22 of the 229 attempted forms where the labial continuants become labial stops. The table in (13) lists representative examples of stopping produced by Jarmo.

(13) Stopping of labial continuants

wipwap	[ʊɪpˌʊɑp]	[ˈpɪpa]	02;00.04
Willy doen	[ˈʊɪli ˈdun]	[ˈbili ˈslu]	02;02.06
water bootje	[ˈʊatər ˈbotjə]	[ˈbaʂə ˈboʃə]	02;03.09
fietsen	[ˈfitsən]	[ˈpiʃ̬]	01;11.20
rijstwafel	[ˈrɛistˌʊafəl]	[ˈlɛiʂəˌʊapoʊ̆]	02;02.27
voetjes	[ˈvutjəs]	[ˈpuces]	02;00.28

In sum, the data covered in this section illustrate a general production problem when labial continuants are attempted in onset position. This problem is solved through three main production strategies, namely coronal substitution, debuccalization, and stopping. These strategies alone account for 68% of the overall data, and for 83% of all the cases of non-target-like production of labial continuants in onset. In addition, when factors such as lexical effects are taken into consideration, all of these patterns occur irrespective of the place feature of the adjacent vowel. In chapter 5, I will argue that the selection of a coronal as the substitute (default) consonant is reflective of the special unmarked nature of coronals both universally and within the Dutch language. In this context, debuccalization also appears as neutralization to a default status, namely through removal of all place features from the representation (e.g. Clements and Hume 1995, Rice 1996).

In the next section, I continue my discussion of apparent cases of consonant harmony by discussing the fate of target velars.

4.2 Production Strategies Affecting Velars

Several production strategies affect target velar segments. Velar segments can be divided into two groups based on their position within the syllable. I provide a distribution of these segments in (14).

(14) Distribution of velar segments in Jarmo's attempted forms

Attempted velars 729	
Velars in onsets 492	Velars in codas 237

I first examine the coping strategies affecting velars in onset position in the next subsection.

4.2.1 Velars in Onsets

Velar segments in onsets are largely unproblematic for Jarmo from the perspective of all attempted forms. However, significant patterns of apparent harmony result from production strategies targeting these segments. I provide a distribution of strategies affecting velars in onsets in (15).

(15) Distribution of velars in onsets

Attempted forms	492	
Target-like	357	73%
Coronal substitution	62	13%
Deletion	23	5%
Debuccalization	18	4%
Labial substitution	11	2%
Other	21	4%

As can be seen from the above compilation, the attempted velars in onsets are target-like in 357 (73%) of the 492 cases attempted. I provide representative target-like productions in (16).

(16) Target-like velars in onsets

klaar	['klaɪ]	['k̲aː]	01;05.27
kijken	['kɛikə]	['kɛik]	01;06.13
kikker	['kɪkəɪ]	['kikɑ]	01;09.23
draaien	['dʀajən]	['ʀɛijə]	01;10.09
klok klok	['klɔk ˌklɔk]	['kɔk ˌkɔk]	01;10.09
koekje	['kukjə]	['k͡jʉ]	01;10.09
kousje	['kɑusjə]	['kɑisjɑ]	01;10.09
brokje	['bʀɔkjə]	['bjɔk͡jə]	02;02.06

In spite of the seemingly unproblematic nature of these consonants, a noticeable pattern of coronal substitution also emerges, sometimes resulting in coronal-harmonized outputs. I illustrate some of these cases in (17).

(17) Coronal substitutions affecting velars in onsets

kijk eens	['kɛiˌkəns]	['kɛiˌjɪs]	02;00.28
kleien	['klɛijə]	['tɛinə]	02;00.28
rijden	['ʀɛidə ('ʀɛijə)]	['lɛijə]	02;01.08
sturen	['styʀə]	['tyjə]	02;02.27
daar op	['daʀɔp]	['dalɔ]	02;04.01
kip	['kɪp]	['tɪp]	02;02.27
Kokkie	['kɔki]	['kɔli]	02;03.09
giraf	[ʒʲi'ʀɑf]	['tɑpʰ]	02;01.22

Coronal substitutions affect 62 velars in onsets. From these 62 cases, 33 result in coronal-harmonized forms. 25 of these 33 coronal-harmonized forms also display C-V identity.

While this evidence appears to support a partial specification hypothesis, I argue, in Chapter 5, that the harmonizing effects seen with coronal vowels and consonants in the Dutch data in fact result from the frequent occurrence of these segments in the language.

Coronal is not the only substituting feature targeting velars; cases of labial substitution are also attested in the data. These cases appear in the larger picture to be rather marginal. However, these cases account for some of the labial-harmonized forms reported in (1). Labial substitution is present in 11 of the attempted velars in onsets. Of these 11 cases, three result in labial-harmonized forms. All three of these cases display C-V identity. Note however that the examples all appear on or after the age of 1;11.06. As such, they cannot support a partial specification hypothesis, which should in principle hold only during the child's early productions, that is, at a time when lexical representations are not fully specified in the lexicon.

I turn now to a discussion of the production strategies affecting velars in codas.

4.2.2 Velars in Codas

Velars in codas, unlike velars in onsets, appear to be much more problematic. To illustrate this point, I first provide a distribution of production strategies affecting attempted velars in codas in (18).

(18) Distribution of velars in codas

Attempted forms	237	
Target-like	90	38%
Deletion	112	47%
Become onsets	12	5%
Labial substitution	10	4%
Coronal substitution	5	2%
Other	8	3%

As is evident from (18), only 90 (38%) of the attempted velars in coda position are produced in a target-like fashion by the child. I illustrate some of these target-like examples in (19).

(19) Target-like velars in codas

boek	['buk]	['buk]	01;10.23
klok	['klɔk]	['kɔk]	01;10.23
kijk	['kɛik]	['kak]	01;11.20
tiktak	['tɪkˌtɑk]	['tɪktɑk]	01;11.20
oog	['oχ]	['ʔok]	02;00.04
ook	['ok]	['ʔok]	02;00.04
weg Paula	['ʋɛχ 'pɑula]	['ʋɛχ 'poˑlaː]	02;02.06

A process of segmental deletion affects 112 (47%) of Jarmo's attempted velars in codas. I list representative examples of this pattern in (20).

(20) Segmental deletion affecting velars in codas

tok tok tok	['tɔk ˌtɔk ˌtɔk]	['taːə̯ˌdɑˌda]	01;07.15
hier	['hiʁ]	['ʔɪə̯]	01;07.29
vliegtuig	['vliχˌtœyχ]	['titɑ]	01;07.29
dààg	['dɑɑχ]	['d̪a͡ɑ]	01;09.09
die ook beer	['di 'ʔok 'beɪ]	['di 'ʔo 'piə]	02;00.28
hert	['hɛʁt]	['hɛt]	02;01.22
kijk	['kɛik]	['kɛi]	02;04.01

Although they represent only 6% of the data combined, production strategies of labial- and coronal substitution affecting velars in coda position are also found, some of which result in apparent consonant harmony.

Labial substitution affects velars in codas in 10 of the attempted forms. Four of these 10 result in labial-harmonized forms, all of which also display C-V identity. Coronal substitution affects 5 velars in coda position. Three of these result in coronal-harmonized forms. Of these harmonized cases, two display C-V identity. However, all forms with C-V identity both with labials and coronals are attested during the later part of the data gathering period, on or after 1;09.09. As such, similar to the substitutions affecting velars in onsets discussed above, these cases do not support a partial specification analysis, which should apply for early word productions only.

In the next section, I move to a discussion of coronal segments in order to illustrate the source of the remaining cases of labial and dorsal harmony.

4.3 Production Strategies Affecting Coronals

Coronals appear to be largely unproblematic for Jarmo. I provide a distribution of attempted coronal segments according to position within the syllable in (21).

(21) Distribution of coronal segments in Jarmo's attempted forms

Attempted coronals 2267	
Coronals in onsets 1226	Coronals in codas 1041

I first discuss production strategies affecting the 1226 attempted coronals in onset position.

4.3.1 Coronals in Onsets

In this section, I discuss strategies targeting coronals in onset position. I illustrate a breakdown of patterns affecting these segments in (22).

(22) Distribution of attempted coronals in onsets

Attempted forms	1226	
Target-like	840	69%
Deletion	109	9%
Labial substitution	73	6%
Dorsal substitution	53	4%
Stopping	47	4%
Become onsets	33	3%
Other	71	6%

As can be seen, 840 (69%) of the attempted coronals in onsets are produced as target-like. I illustrate some of these examples in (23).

(23) Target-like coronals in onsets

daar	['daɪ]	['daː]	01;06.27
Dicky Dick	['dɪki 'dɪk]	[ˌd̈ä'tɪ]	01;08.12
eendje	['entjə]	['ʔe͡tjä]	01;09.23
trein	['tʀɛin]	['tlɛi]	01;10.09
tok tok tok	['tɔk ˌtɔk ˌtɔk]	['toutɔtɔt]	01;11.06
boek tekenen	['buk 'tekənən]	['tü 'tekə]	02;02.06
die ballon	['di bɑ'lɔn]	['di 'lɔm]	02;03.09
ik ook staartje	['ʔɪk 'ok 'startjə]	['m̩ 'ʔok 'tacə]	02;03.09
leuk	['løk]	['løk]	02;04.01

In addition, a production strategy of segmental deletion affects 109 (9%) of the coronals in onset position. I illustrate some representative examples of this pattern in the table in (24).

(24) Segmental deletion of coronals in onsets

trein	['tʀɛin]	[ʁɑ'χe͡ĭ]	01;09.09
klaar	['klaɪ]	['ka]	01;10.23
stoel	['stul]	['tuə]	01;11.20
slaapt	['slapt]	['lap]	02;00.04
trekker	['trɛkər]	['tɛkʉ]	02;00.04
tractor	['tʀɛktɔʀ]	['t͡jɛʁkə]	02;01.22
schommel	['sχɔməl]	['χɔmo͡ŭ]	02;02.27
sneeuwpop	['sneuˌpɔp]	['nɪpoːp]	02;03.09

As we can see from these examples, coronal segments undergoing this pattern of segmental deletion originate from consonant clusters. 102 of the 109 cases (94%) appear on or after age 1;09.09, which indicates difficulties with the production of onset clusters even in relatively late productions. This issue, which is tangential to the questions addressed in this thesis, will not be addressed further. The interested reader can consult

Fikkert (1994) for a detailed account of prosodic development in Jarmo's and other Dutch-learning children.

Although they only represent 10% of the data combined, processes of dorsal and labial substitution affecting coronal segments are found in Jarmo's onsets. I discuss these cases because they sometimes contribute to the cases of harmonized forms listed in (1).

Labial substitution affects 73 of the attempted coronals in onsets. These 73 cases result in 27 labial-harmonized forms, which account for 42% of the 64 cases of labial harmony. Of these 27 harmonized forms, 19 display C-V identity. However, a closer look at these 19 cases reveals that 14 of them come from a single word, *Paula* [pɑula] whose [l], as already mentioned in section 3, typically surfaces as a labial approximant.

Dorsal substitution affects 53 of the attempted coronal segments in onsets. Of these 53 cases, 21 result in dorsal-harmonized forms. These 21 cases account for 44% of the 48 cases of dorsal harmony. Of the 21 harmonized forms, only nine show C-V identity.

Finally, I turn to a discussion of coronal segments in coda position.

4.3.2 Coronals in Codas

As opposed to coronals in onsets, we find a general production problem affecting coronal segments in codas. I provide a distribution of the production strategies affecting these segments in (25).

(25) Distribution of attempted coronals in codas

Attempted forms	1041	
Target-like	308	30%
Deletion	614	59%
Labial substitution	59	6%
Become onsets	24	2%
Dorsal substitution	22	2%
Other	14	1%

Coronals in codas are target-like in 308 (30%) of the attempted forms. I illustrate some of these examples in (26).

(26) Target-like coronals in codas

huis	['ɦœys]	['ʔœy̟s̟]	01;08.26
eend	['ent]	['ʔɛ̟t͡s̟]	01;09.09
ijs	['ɛis]	['ʔɛi̟s̟]	01;09.09
maan	['man]	['maˈn̟]	01;09.09
aapje is dit	['ap͡jə 'ʔɪs 'dɪt]	['ʔap͡jə ˌʔɪs 'tɪt]	01;11.20
vasthouden	['vɑstˌɦɑudə]	['fɑstˌɦɑuʋə]	02;01.08
struisvogel	['stʀœysˌvoχəl]	['tœy̟s̟ˌfoχo̯ŭ]	02;01.22
poes	['pus]	['pus]	02;03.09

A process of segmental deletion affects 614 (59%) of the attempted coronal segments in codas. I illustrate representative examples of this pattern in the table in (27).

(27) Segmental deletion of coronals in codas

klaar	['klaɪ]	['ka]	01;06.13
boot	['bot]	['poŭ]	01;08.26
Ernie	['ɛɪni ('ʌɪni)]	['hãni]	01;09.23
fietsen	['fitsən]	['ʔiʃə]	01;09.23
loopt een schaap	['lopt ən 'sχap]	['hopə'la]	02;00.28
bal	['bɑl]	['bɑŭ]	02;03.09
een	['en]	['ʔɛ]	02;03.09

Most of these cases of coronal segments undergoing deletion originate with sonorant coronals in coda position. In section 4.3.3, I address the issues affecting all attempted sonorant codas in Jarmo's productions.

As can be seen in (25), combined labial and dorsal substitution patterns only account for 8% of the data on coronals in codas. These examples must however be discussed in order to attain a full description of the apparent cases of labial and dorsal harmony.

Labial substitutions affect 73 of the coronals attempted by Jarmo in coda position, 29 (40%) of which result in labial-harmonized forms. These 29 cases account for 45% of the 64 cases of apparent labial harmony. Out of the 29 harmonized forms, 16 cases display C-V identity. Of these 16, 14 (88%) originate from sonorant coronals such as [l] already discussed in section 4.3. In addition, 14 (88%) of the 16 cases with C-V identity appear after 1;09.09, during the last 7 months recording.

Dorsal substitutions affect 22 coronal segments in coda position, seven of which result in velar-harmonized forms. These seven cases account for 15% of the 48 apparent

cases of dorsal harmony. Of these seven dorsal-harmonized cases, three display C-V identity.

In order to address the overwhelming number of cases of segmental deletion affecting coronal sonorants in coda position discussed in (25), I turn to a discussion of all sonorant codas in the following section.

4.3.3 Sonorants in Codas

As was seen above in section 4.3.2, a large number of segmental deletions affect coronal sonorants in codas. In this section, I discuss this deletion pattern in light of the behavior of all sonorant codas found in the corpus. From a general perspective, sonorant codas appear to be highly problematic in Jarmo's speech, be they nasal, rhotic, or lateral.

Although the production strategy of deletion of sonorants is not equally prominent for each of the sonorant coda types (nasal, rhotic, lateral), several deletions are found in each case, which in fact affect most of the target sonorant codas attempted by the child. I first examine nasal codas in the next subsection.

4.3.3.1 Nasals in Codas

Nasal codas appear more frequently in target forms than the other types of sonorant codas. These codas are also the ones that are the least affected by deletion, as we will see in the following sections. 343 nasal codas were attempted by Jarmo, out of which only 53 (15%) are produced as target-like. Deletion affects 234 (68%) of the nasal codas

codas attempted. The table in (28) provides examples of this pattern of nasal coda deletion.

(28) Deletion of nasal codas

stoel maken	['stul 'makən]	['tufə 'makə]	02;03.09
even draaien	['evən 'dʀaijən]	['hejə 'tʊa̲jə]	02;04.01
drinken	['dʀɪŋkən]	['tekə]	01;10.23
ganzen	['χɑnzən]	['hɑːs̲ə]	02;02.06

I attribute the lack of labial nasals in the examples in (28) to the overall rarity of these segments in the language. This issue is discussed further in chapter 5. Of the remaining 56 examples (17%), 35 undergo place substitution and 21 cases cannot be attributed to any systematic pattern.

4.3.3.2 Laterals in Codas

Lateral codas are also problematic for Jarmo. Two main production strategies affect the target laterals in coda. Because these patterns are intertwined in the data, they cannot be related to a specific period of acquisition and, as such, appear to result from coping strategies for segments that Jarmo cannot produce. Out of 165 attempted lateral codas, Jarmo produced only 12 (7%) target-like forms. Jarmo deletes 121 (73%) of the lateral codas attempted. Some representative examples of this are provided in (29).

(29) Deletion of lateral codas

vogel	['voχəl]	['foχɔ]	02;00.04
melk	['mɛlk]	['mą̱'k]	02;03.09
schommel	['sχɔməl]	['χɔmoŭ]	02;02.27
bril	['bʀɪl]	['bɪə]	02;03.09
bal	['bɑl]	['bɑ]	01;07.15
stoel	['stul]	['tu]	02;00.04

Lateral codas also undergo harmony, as was discussed briefly in section 4.3.2. I look at these cases in more depth here. The table in (30) illustrates representative examples of labial harmony affecting lateral codas.

(30) Labial harmony affecting lateral codas

appel	['ɑpəl]	['ʔɑpɔm]	02;03.09
uil	['œyl]	['ʔœʊ]	01;09.23
kameel	[ˌka'mel]	['meuw]	02;03.09
bal	['bɑl]	['boʊ]	01;10.09
nee Selma	['ne 'sɛlma]	['neĭ 'nɛwma]	02;02.06
wortel	['ʊɔrtəl]	['tɑtɔw]	02;01.08
stoel	['stul]	['tuʊə]	01;10.23

As we can see from these examples, when target laterals are produced, they become harmonized. This harmony process accounts for 27 of the 165 target laterals (16%). (These examples were included in the total cases of substitution affecting coronals in codas in (25).) Finally, the remaining 6 cases are unclassifiable.

4.3.3.3 Rhotics in Codas

Similar to the other sonorants, rhotics in codas are problematic for Jarmo. Indeed, the child produces these consonants in only 3 of the 285 (1%) attempted forms. 264 (92%) of these consonants undergo deletion. This deletion pattern is exemplified in (31).

(31) Deletion of rhotics in codas

klaar	['klaɪ]	['kla]	01;11.06
schaar	['sχaʀ]	['taˈ]	01;10.09
tovernaar	['tovənar]	['toχənaːə]	02;03.09
lekker	['lɛkəɪ]	['lɛkə]	02;02.06
tractor	['tʀɛktɔʀ]	['t͡jɛʁkə]	02;01.22
meer vogel	['mer 'voχəl]	['mi 'kofoŭ]	02;00.28

Of the 18 remaining cases, nine rhotics are resyllabified in onset position and nine cannot be classified according to any leading pattern.

As we can see from the compilations above, the deletion pattern affecting coronals in codas is not targeting coronal consonants in particular but rather reflects a syndrome that generally affects all sonorants attempted by Jarmo in coda position. (For a more in depth discussion of sonorant consonants in Dutch the interested reader may look to van den Heuvel and Cucchiarini, 2001, and van der Torre, 2003).

4.4 Interim Summary

In sum, coronal segments in both onsets and codas undergo a process of segmental substitution which sometimes results in apparently harmonizing forms. These cases of substitution are most often ones of labial substitution, with also a noticeable

pattern of dorsal harmony. In addition, sonorant codas pose a general problem in the Jarmo corpus. These segments largely undergo a production strategy of segmental deletion.

Finally, as was briefly discussed above, a small time frame was detected, during which coronal harmony affecting labial stops is attested in a systematic fashion. I discuss this pattern in more depth in the next section.

5. Coronal Harmony

During the period between 1;11.20 and 2;02.06, 233 attempts at labial stops in onsets are attested in the corpus. Of these, 31 have the required environment for coronal harmony, which requires the consonant following the vowel adjacent to the target labial onset to be coronal, forming a PVt sequence where 'P' stands for a labial stop, 'V' for a vowel and 't' for the coronal consonant [t]. The table in (32) provides a breakdown of the different realizations of these forms during this period of three and a half months.

(32) Distribution of PVt sequences from 1;11.20-2;02.06

Attempted Forms	31	
Target-like	5	16%
Coronal Harmony	24	77%
Other	2	6%

Of the 31 labial stops attempted during this period, only five (16%) are produced as target-like. I list in (33) all such realizations.

(33) Target-like PVt sequences from 1;11.20-2;02.06

aardbeitje	['aɪd̪bɛitjə]	['ʔapɛit͡ʃ̆ə]	02;02.06
beertje	['beɪtjə]	['biətə]	02;00.04
schildpad	['sχɪl̪pɑt]	[ʔə'paət]	01;11.20
beertje	['beɪtjə]	['bɪˑtiə]	01;11.20
beertjes	['beɪtjəs]	['pɪt͡jəs]	01;11.20

In 24 cases (77%), the labial stops [p, b, m] are realized as coronal. I analyze these substitutions as real cases of coronal harmony. (Six additional cases of coronal harmony also appear outside of the timeframe suggested for this stage.) Indeed, as we can see in (34), cases of [t] triggering coronal harmony in [p, b, m] appear across all types of vowels, for example [œ, y] in *buiten* ['bœytən] and *muts* ['mœts], [ɑ] in *bad* ['bɑt], and [o] in *boot* ['bot]. This production strategy is thus not the result of feature sharing between consonants and vowels; the only regular trigger is the [t] that follows the target labial.

(34) Coronal harmony in PVt words

buiten	['bœytən]	['tœytə]	02;00.28
schildpad	['sχɪl̪pɑt]	['t̪itaːt]	01;11.20
bad	['bɑt]	['tɑ̪t]	02;00.28
hier kapot	['hir ˌkɑ'pɔt]	['hiə 't͡jɔt]	01;11.20
boot	['bot]	['toˑt]	02;00.04
muts	['mœts]	['tytst]	02;01.22

One other characteristic of this pattern that reinforces its interpretation as true consonant harmony is that it takes place between stop consonants only. Indeed, during the same time period, labial stops are generally not harmonized if they are followed by the coronal fricatives [s, ʃ] (e.g. *muisje* ['mœyʃə] → ['mos̪͡jə] 2;01.22; *poes* ['pus] → ['pus̪] 2;01.08;

and *poesjes* ['puʃə] → ['puʃə] 2;01.22. This observation suggests an influence of manner of articulation on the manifestation (or lack thereof) of the coronal harmony process.

6. Discussion

As was discussed in chapter 2, the partial specification hypothesis posits that in the early stages in the development of the lexicon, a child may have, for any given word attempted, a unique place feature that is shared by consonants and vowels. On the surface, this sharing is reflected through place feature identity between consonants and adjacent vowels. In this section, I discuss the cases that arise in my data that result in apparent labial, coronal, and dorsal harmony in light of this prediction. In order to achieve this, I first discuss the patterns affecting coronals and velars which result in cases of apparent labial harmony. Second, I discuss patterns appearing with velars and labials resulting in cases of apparent coronal harmony. Finally, I discuss the cases where labials and coronals are affected producing velar-harmonized forms. This discussion is primarily based on the proportions of harmonized forms that display C-V identity across the data set.

6.1 Apparent Cases of Labial Harmony

As we saw in (2) above, 64 words are attested in the corpus in which production strategies affecting coronal and velar segments result in labial-harmonized forms. In (35), I provide a distribution of these forms based on the production strategy causing the form

to be harmonized. For a complete compilation of labial-harmonized forms, see Appendix A1.

(35) Production strategies contributing to apparent labial harmony

Production strategies resulting in apparent labial harmony	**Apparent CH**
Labial substitution affecting [l] in onsets	18
Labial substitution affecting [l] in codas	19
Labial substitution affecting coronals in onsets	9
Labial substitution affecting coronals in codas	10
Labial substitution affecting velars in onsets	3
Labial substitution affecting velars in codas	4
Reduplication	1
Apparent labial harmony	**64**

Although many cases of labial substitution do not result in labial-harmonized forms, the vast majority of these forms, 56/64 (88%) come from cases of labial substitutions targeting coronals, about two thirds of which are the lateral approximant [l]. As was reported in 4.3.1, 27 harmonized forms result from coronals in onsets undergoing labial substitution, 19 of which display C-V identity. A closer look at these 19 cases reveals that 14 come from a single word, *Paula* [pɑula]. It was reported in section 4.3.2, that 29 labial substitutions affect coronals in codas, 16 (55%) of which display C-V identity. Out of these 16, 14 (88%) of these also originate from target [l] in codas. In addition, 14 (88%) of the cases with C-V identity appear after 1;09.09, that is during the last 7 months covered by the recording sessions. It follows from these facts that labial substitutions affecting coronal segments are independent of any process of harmony. Also, if the partial specification hypothesis held true, one would expect higher frequencies of C-V

identity in the harmonized forms and these forms should appear in the earlier months reported on.

Most of the remaining seven cases of labial-harmonized forms come from labial substitutions affecting velars. As was reported in section 4.2, all cases of these labial substitution targeting velars that result in harmonized forms display C-V identity. As such, these examples appear to support the partial specification hypothesis. However, all of these forms appear on or after 01;09.09, that is, in somewhat late forms for the child. An analysis based on partial specification would predict these forms to show up in early productions. Finally, one final case of labial harmony arises in the form *olifant deze* ['oli,fɑnt 'dezə] which becomes reduplicated and results in the form ['ʔofɑ̃,fɑ̃ 'deːs].

As we can see from this summary, the production strategies resulting in labial harmony come primarily from segmental substitutions affecting coronals to a large extent, and, more specifically, the lateral [l]. Without the contribution of the labial-harmonized cases from the latter, labial harmony would have been rather marginal. We can conclude from this that no harmonizing process per se took place in this context and that the labial-harmonized cases are artifacts of the inaccurate production of certain sounds during phonological development. I turn now to a discussion of the apparent cases of coronal harmony found in Jarmo's productions.

6.2 Apparent Cases of Coronal Harmony

As was seen in (4) above, coronal harmony is attested in 147 words produced by Jarmo. I provide in (36) a distribution of these forms based on the production strategies

that result in coronal-harmonized forms. For a complete listing of apparent cases of coronal harmony, see appendix A2.

(36) Production strategies contributing to apparent cases of coronal harmony

Production strategies resulting in apparent labial harmony	**Apparent CH**
Coronal substitution of labial continuant onsets	69
Coronal substitution of labial continuant codas	2
Real coronal harmony targeting labial stops in onset	30
Coronal substitution of labial stops in onsets	8
Coronal substitution of labial stops in codas	1
Coronal substitution affecting [h]	1
Coronal substitutions affecting velars in onsets	33
Coronal substitutions affecting velars in codas	3
Apparent coronal harmony 147	147

Cases of coronal substitution affecting labial and velar segments appear at first to minimally comply with the predictions of the partial specification hypothesis. As was reported in section 4.1.1, six of these eight (75%) coronal-harmonized labial stops in onsets display C-V identity. Coronal substitution of labial continuants results in 69 coronal-harmonized forms, 54 (78%) of which also have C-V identity as was reported in section 4.1.2. However, as noted above, a closer look at these cases reveals that 25 of the 54 cases (46%) result from the word *Willy* [ʋili] produced as [lili]. Finally, one case where coronal substitution affects a labial stop in coda position results in a harmonized form, and on two occasions coronal substitution affects labial continuants in coda position, which results in two coronal-harmonized forms. All three of these cases of coronal-harmonized labial codas display C-V identity.

Coronal substitutions was seen in section 4.2 to affect velars in onsets resulting in 33 coronal-harmonized forms, 25 (76%) of which display C-V identity. Coronal substitution also affects velars in codas, resulting in three (60%) harmonized forms, two of which display C-V identity.

Overall, the numbers provided in this section suggest a role for place feature sharing between consonants and vowels in coronal-harmonized forms, which itself suggests a role for partial specification. However, I will argue in chapter 5 that this apparent preference for identity among coronal consonants and vowels actually results from independent facts. First, there is a high frequency of coronal segments in the language, which increases the odds of place feature identity between front vowels and coronal consonants in the produced words. Second, in line with Fikkert and Levelt (2006), I will argue that the high frequency of occurrence of the coronal feature in the language makes this feature a prime candidate to become a default articulator for the learner. Before I tackle this argument in its detail, I summarize, in the next section, the production strategies resulting in apparent cases of velar harmony.

6.3 Apparent Cases of Dorsal Harmony

As was seen in (5) above, 48 apparent cases of velar harmony are attested in the corpus. I provide a distribution of these cases based on the production strategies resulting in velar-harmonized forms in (37). See Appendix A3 for a detailed list of all cases of apparent velar harmony.

(37) Production strategies resulting in apparent dorsal harmony

Production strategies resulting in apparent labial harmony	**Apparent CH**
Dorsal substitution targeting labial continuants in onsets	8
Dorsal substitution targeting labial stops	12
Dorsal substitution targeting coronal onsets	21
Dorsal substitution targeting coronal codas	7
Apparent dorsal harmony	48

As discussed in section 4.1.1, dorsal substitutions affect labial stops in onsets, resulting in 11 harmonized forms, seven (64%) of which display C-V identity. We also saw in section 4.1.2, the dorsal substitution affects labial continuants in onsets resulting in eight dorsal-harmonized forms, two (25%) of which display C-V identity.

Dorsal harmony affecting coronals yields similar results. Less than half of the coronal onsets and codas undergoing dorsal substitution result in dorsal-harmonized forms. We saw in section 4.3.1 that dorsal substitutions target coronals in onsets, resulting in 21 (51%) dorsal-harmonized forms, nine of which display C-V identity. Dorsal substitutions affect coronals in codas, resulting in seven (32%) apparent cases of dorsal harmony, three (43%) of which additionally display C-V as was seen in sesction 4.3.2.

Overall, the data on the relatively few cases of dorsal-harmonized forms do not provide much support for the partial specification hypothesis. At best, the predictions made by this hypothesis are borne out in about half of the examples. In addition, similar to the other harmony patterns found in the child's outputs, several of the substitutions that result in apparently harmonized forms occur independently of harmony itself. This implies that, except from the case of coronal harmony discussed in section 5, consonant

harmony in Jarmo's outputs is largely an artifact of segmental substitution, a production strategy which relates to the acquisition of specific sounds in specific positions within the syllable.

However, throughout the chapter, we have observed that most of the segmental substitutions and the highest proportions of forms showing C-V identity relate to the feature coronal. As we will see in chapter 4, this observation will also prove to be relevant for Eva. This generalization, which points to a central aspect of both Jarmo's and Eva's developing phonology, is revisited in chapter 5, where I discuss potential effects that input frequency may have had on the children's developing system.

Chapter 4 - Eva: A Case Study

1. Introduction

In this chapter, I discuss some of these patterns resulting in harmonized forms in Eva's productions. These patterns shed light on the factors conditioning the harmony effects attested. As we will see, these factors reveal aspects of the child's developing grammar beyond the harmony cases themselves. I first provide a general picture of the apparent CH cases. I then move to a more detailed characterization of the factors conditioning these harmony cases.

The chapter is organized following the same layout as the preceding chapter, to facilitate comparisons between the two case studies. In section 2, I provide a general classification of apparent cases of harmony, broken down into each relevant consonantal and vocalic context. I then narrow the focus and concentrate on which consonants are targeted by the harmonizing processes, in section 3. Section 4, I provide a discussion of each pattern resulting in harmonized forms affecting velars, labials, and coronals, respectively.

2. Apparent Cases of Consonant Harmony in Eva's Productions: An Overview

In this section, I provide a general overview of the cases of apparent consonant harmony found in Eva's productions. The table in (1) provides a distribution of all cases of apparent consonant harmony found in the corpus represented by single letters corresponding to the place of articulation of consonants and vowels.

(1) Apparent Cases of Consonant Harmony

a. Apparent labial harmony	68	
PIP	5	7%
PAP	26	38%
PUP	37	54%
b. Apparent coronal harmony	147	
TIT	83	56%
TAT	38	26%
TUT	26	18%
c. Apparent dorsal harmony	2	
DID	0	0%
DAD	1	50%
DUD	1	50%
Total cases of apparent consonant harmony	207	

The cases of apparent consonant harmony appear, at first glance, to be unevenly distributed across the vowels. The patterns are in fact quite prototypical of the general findings documented in Levelt (1993,1994, 1997) and Fikkert and Levelt (2004, 2006) according to which there seems to be a correspondence between the type of harmony observed and the vowel intervening between the harmonizing consonants. For example, 37 of the 68 (54%) cases of apparent labial harmony occur in the environment of a back rounded vowel and 83 (56%) of the 147 cases of apparent coronal harmony across an intervening front vowel. However, in the next sections, we will see that many of these cases observed can be attributed to just a few triggering contexts, especially to a pattern of segmental substitution affecting velars. While it appears that the intervening vowel in many of these cases is a front vowel, the strategy also manifests itself in the presence of back and rounded vowels.

3. Apparent Cases of Consonant Harmony: A Closer Look

In this section, I address each case of apparent consonant harmony from the perspective of the target consonants affected by the substitutions. This angle on the data reveals a series of production strategies which, when combined, provide a strong predictor for the patterns observed in Eva's productions. For the sake of clarity, I distinguish the strategies found relative to each major place of articulation that acts as a substitute in the data. Beginning with labial consonants, I provide in (2) a breakdown of the consonants affected by the patterns that result in apparent labial harmony.

(2) Apparent labial harmony

Number of Cases	68		
Affecting Coronals 59	Stops	29	43%
	Continuants	30	44%
Affecting Velars 9	Stops	5	7%
	Continuants	4	6%

As can be seen in (2), 59 cases (87%) of apparent labial harmony affect coronals, 30 of which target coronal continuants and 29 of which target stops.

Turning now to cases of apparent coronal harmony, we can observe, in (3) that 102 of the 147 cases (69%) originate from production strategies affecting target velar consonants.

(3) Apparent coronal harmony

Number of Cases	147		
Affecting Labials 45	Stops	39	27%
	Continuants	6	4%
Affecting Velars 102	Stops	96	65%
	Continuants	6	4%

Of these 102 cases, nearly all the examples (94%) affect velar stops. As we will see, a closer look at this pattern, in section 4, reveals that these segments are most often the targets of coronal substitution. Undergoing a substitution pattern similar to that affecting velar stops, labial obstruents are also targeted by coronal substitution, but to a lesser extent.

Finally, I provide a breakdown of the rather marginal cases of apparent dorsal harmony in (4).

(4) Apparent Dorsal Harmony

Number of Cases	2		
Affecting Labials 0	0		
Affecting Coronals 2	Obstruents	2	100%

Because there are so few cases of apparent dorsal harmony, it is impossible to draw any firm conclusion from these data other than saying that they probably result from unsystematic mispronunciations. There are indeed only two cases of dorsal harmony and both cases affect coronal obstruents. Because these marginal cases cannot result from a widely-encompassing pattern in the child's phonology, and because they do not constitute a reliable base from which one can draw any firm conclusion, these cases will not be

addressed further. However, the behavior of coronal obstruents, which are targeted in both of these cases, will be looked at more closely in sections 4.6 and 4.7, where I discuss issues arising where coronal obstruents are targeted by substitutions resulting in apparent labial harmony.

Before I address this point in more detail, I move first to a discussion of production strategies resulting in apparent harmony cases. I examine these strategies from the perspective of the place of articulation of the target consonant affected.

4. Production strategies Resulting in Apparent Consonant Harmony

In order to characterize in more detail the sources of these apparent harmony cases, I look at the patterns from the perspective of the place of articulation of the consonants targeted by the production strategies. I first examine patterns affecting velars which result in the high number of coronal-harmonized forms in the table in (3).

4.1 Production Strategies Affecting Velars in Onsets

As we will see in this section, both velar stops and continuants are problematic for Eva. The table in (5) illustrates the distribution of each class of velars in the onsets of attempted forms.

(5) Attempted velars in onsets

Attempted Velar Onsets 280	
Velar Stops 195	Velar Continuants 85

The child attempts 280 velar onsets. Out of these, 195 are stops and 85 are continuants. First, I look at velar stops as they are produced by the child.

4.1.1 Velar Stops in Onsets

As mentioned above, velar stops in onset position are generally problematic in Eva's productions. The segments are targeted by several production strategies that result in substitution patterns. I provide a breakdown of the patterns affecting velar stops in (6).

(6) Behavior of velar stops in Eva's onsets

Attempted Forms	195	
Target-like	21	11%
Coronal Substitution	149	77%
Labial Substitution	10	5%
Debuccalization	6	3%
Deletion	6	3%
Other	3	2%

Velar stops in onset position are produced as target-like in only 21 of the 195 (11%) attempted forms. Of these 21 target-like forms, 13 (62%) appear on or after the ages of 01;09.08. This evidence suggests that, towards the end of data recording period (1;11.08), the child was in the process of mastering these segments in onset position. I present some representative examples of target-like velar stops in onset position in (7).

(7) Target-like velar stops in onsets

kan niet draaien	['kɑn ˌnit 'dʀaijə]	['kɑ̃ː ˌni 'tɕijə]	01;09.22
ik kan vallen	['ɪk 'kɑn 'vɑlə]	['ʔɪk̚ˌkɑn̚ˌ'fɑlə]	01;11.08
kijken	['kɛikə]	['kɛikə]	01;11.08
maken	['makə]	['makə]	01;11.08
Marieke ook	[ma'ʀikə 'ok]	['ʔikə 'ʔoˑk]	01;11.08

As becomes evident from an examination of the data, the most prominent production strategy targeting velar stops in Eva's productions is coronal substitution, a process also referred to in the literature as velar fronting (Chiat 1983, Brett, Chiat & Pilcher 1987, Stoel-Gammon & Stemberger 1994, Stoel-Gammon & Dunn 1985; Stoel-Gammon 1996, Bills & Golston 2001, Dinnsen 2002, Inkelas & Rose 2006). The table in (8) illustrates some examples of coronal substitution (or velar fronting) produced by Eva.

(8) Coronal Substitution (velar fronting) of velar stops in onsets

vis pakken	['vɪs 'pɑkə]	['hɪs 'pɑˌtə]	01;06.11
kachel	['kɑχəl]	['tɑ'χʷoːm̰]	01;07.22
Marieke puzzel	[ma'ʀikə 'pʉzəl]	['miˑtə 'pʉʂɔː]	01;09.08
openmaken	['opəˌmakə]	['ʔopəˌmaˌtəː]	01;09.08
varken	['vɑɪkə]	['ʊɑtəˑ]	01;09.08
weer klaar	['ʊeɪ 'klaɪ]	['ʊˌɪ 'taɪ]	01;09.08

As indicated in (6), 149 (77%) of the attempted forms undergo coronal substitution. This pattern alone results in a significant portion of the coronal-harmonized forms in Eva's productions. Indeed, while 147 cases of apparent coronal harmony are found in Eva's productions, 70 of these cases (48%) can be accounted for through the fronting of velars in onsets. As we will see below, most of the remaining examples come from coronal

substitutions of velar stops in codas and labial stops in onsets. Linked to these observations is the fact that the patterns of substitution are targeting specific places and manners of articulation in specific positions within the syllable, as will be highlighted further in the upcoming discussions.

Also, it must be noted that the fronting of velars in onsets appears independently of the consonantal and vocalic place features of adjacent segments. Out of the 70 harmonized forms, 37 (53%) display C-V identity between the fronted velar and the adjacent vowel. While this majority of examples seems at first glance to support the partial specification hypothesis, a closer examination of these data reveals that 23 of these 37 cases (62%) can be attributed to a single word, *kijk* [kɛik], which is regularly produced as [tɛit]. This word alone thus imposes a significant bias on the proportion of the examples that suggest a C-V identity effect. If we were to disregard this frequently-occurring word, we would be left with only 14 of the harmonized cases displaying C-V identity, which would themselves represent less than a third (29%) of the overall examples. Based on these considerations, two claims can be made about velar fronting. First, this production strategy is independent of consonant harmony itself, because less than half the attestations of this pattern (70 out of 149; 47%) lead to actual harmonized forms. Second, as discussed just above, velar fronting is independent from C-V interactions.

I move on now to a discussion of the 10 cases (5%) of labial substitution affecting velar stops in onsets, which sometimes result in labial-harmonized forms. I illustrate some of these cases in (9).

(9) Labial substitution affecting velar stops

klok	['klɔk]	['pɔʔt]	01;06.01
koffie	['kɔfi]	['pɔf]	01;06.01
koe	['ku]	['puː]	01;06.11
weer bijna klaar	['ʋeɪ 'bɛina 'klaɪ]	['ʋeɪ 'tɛin 'paˑʔ]	01;09.08

This pattern of segmental substitution targeting velar stops contributes three out of the 68 cases (4%) that result in apparent labial harmony. All three of these cases have C-V identity. However, they all stem from the same word *koffie* ['kɔfi] becoming ['pɔf]. Therefore, no real conclusion can be drawn from these data regarding the phonological motivations behind this rather marginal assimilation process.

I turn now to a discussion of velar continuants in onsets, in an attempt to further uncover the production strategies resulting in harmonized forms, some of which may relate to differences in manners of articulation, as was evidenced from Jarmo's data in the preceding chapter.

4.1.2 Velar Continuants in Onsets

Velar continuants in onsets also undergo production strategies in a majority of the attempted cases. The table in (10) illustrates a breakdown of patterns affecting velar continuants in the child's productions.

(10) Behavior of velar continuants in Eva's onsets

Attempted Forms	85	
Target-like	14	16%
Debuccalization	28	33%
Deletion	17	20%
Coronal Substitution	15	18%
Labial Substitution	6	7%
Other	5	6%

Velar continuants are produced as target-like in 14 (16%) of the 85 attempted forms. These target-like forms are distributed throughout the ages from the earliest to the latest productions. This observation suggests that the child had generalized production problems with these consonants throughout the period covered by the corpus, during which accurate productions are attested only sporadically. I provide some representative target-like forms in (11).

(11) Target-like velar continuants in onsets

tijger	['tɛiχəɪ]	['tɛ̟ix:ə]	01;06.01
vliegen	['vliχə]	['hɪχɛ]	01;06.01
vogel	['voχəl]	[ʔo̟ŭχə]	01;06.01
nagel	['naχəl]	['na:'χo:]	01;08.12
schildpad	['sχɪlpɑt]	['s̆χɪ̆u'pɑu]	01;09.08

As indicated in (10), velar continuants in onsets are debuccalized in Eva's productions in 33% of the cases. Out of the 28 cases of debuccalization, 27 appear on or before the age of 1;07.22. The table in (12) illustrates this pattern.

(12) Debuccalizations of velar continuants in onsets

schoenen	['sχunə]	['hũnˈə]	01;06.01
school ?	['sχol]	['ʔoː]	01;06.01
groot	['χʀoˈt]	['hoːt]	01;06.11
geitje	['χɛitjə]	['fiɛitəː]	01;07.15
schommel	['sχɔməl]	['fiɔmɔ̈]	01;07.15

We also observe a pattern of segmental deletion affecting 17 (20%) of the attempted velar continuant onsets. In 15 of the 17 cases (88%), the segments are part of a larger consonant cluster. I illustrate some of these examples in (13).

(13) Segmental deletion of velar continuants in onsets

vergeten	[vəɹ'χetə]	['eːtə]	01;06.11
schaap	['sχap]	['s̪apʷ]	01;09.08
schildpad dat	['sχɪlt̪pɑt 'dɑt]	['s̪ɑu̪p̪ɑt̪ 'd̪ɑːt]	01;09.08
schommelen	['sχɔmələ]	['s̪ɔməː]	01;09.22
Eva schoenen aan	['eva 'sχunə 'an]	[ʔef 's̪unə 'ʔaˈn]	01;11.08
schoteltje	['sχotəlt̪jə]	['s̪oːt̪oːt̪ʰɪ]	01;11.08

An additional 14 cases are found where velar continuants in onsets undergo a pattern of coronal substitution. I provide representative examples of this in (14).

(14) Coronal Substitution of velar continuants in onsets

getsie	['χɛtsi]	['dæːt]	01;06.01
die gegeven (?)	['di χə'χevə 'pɑpa]	['di ǰeːtə 'pɑ'pa]	01;07.15
papa			
papagaai	[ˌpɑˌpa'χai]	['tæ̞ːi]	01;07.22
kachel	['kɑχəl]	['tɑˌtɔχ]	01;08.12
gele	['χelə]	['s̪eːlə]	01;11.08
groen	['χʀun]	['tyn]	01;11.08

Out of the 14 cases of coronal substitution affecting velar continuants in onsets, 13 appear on or after the age of 01;07.15. This suggests that the child may be developing a new strategy for coping with these segments after this point in time, after favoring debuccalization in the earlier portion of the corpus. This production strategy of coronal substitution affecting velar continuants in onsets contributes only six of the 147 cases (4%) of apparent coronal harmony. Four of these six harmonized forms also have C-V identity, a number again here to low to speculate on the phonological underpinnings of a potential interaction between consonants and vowels.

Six cases of labial substitution affecting velar continuants in onsets also exist in this data set. Four of these cases contribute to the 68 cases of apparent labial harmony, accounting for 6% of these data. Two of these four have C-V identity.

In sum, velar continuants are generally problematic across the entire corpus. Between the early recording sessions until the week beginning at Eva's age of 1;07.15, most of these consonants underwent a pattern of debuccalization. Following this, target velar continuants underwent a series of reduction strategies, most prominently deletion from clusters and segmental substitution in singleton onsets. The latter contributed to the apparent cases of consonant harmony found in Eva's data.

I turn now to a discussion of velar segments in coda position, in order to determine whether position within the syllable (coda versus onset) had a determining effect on the realizations of these consonants.

4.2 Production Strategies Affecting Velars in Codas

Throughout the corpus, Eva attempted a total of 208 velars in coda position. I provide a breakdown of the distribution of these velar codas relative to manner of articulation in (15). As we can see, of the 208 attempted cases, 144 are velar stops and 64 are velar continuants.

(15) Attempted velars codas in Eva's productions

Attempted Velar Codas 208	
Velar Stops 144	Velar Continuants 64

As we will see in the next sections, velar stops in coda position are generally problematic, whereas the production of velar continuants in the same position appears to be largely unproblematic.

4.2.1 Velar Stops in Codas

Beginning with production strategies affecting velar stops in coda position, I provide, in (16), a breakdown of the behaviors observed.

(16) Behavior of velar stops in Eva's codas

Attempted Forms	144	
Target-like	21	15%
Coronal Substitution	70	49%
Deletion	31	22%
Becomes onset	19	13%
Other	3	2%

Velar stops in coda position are produced as target-like by Eva in only 21 (15%) of the 65 attempted forms. 18 of these forms (86%) appear on or after the age of 1;09.08. This reinforces the observation made above in section 4.1.1 that 1;09.08 marks a milestone in Eva's acquisition of these consonants. Representative examples of target-like productions are given in (17).

(17) Target-like velar stops in codas

die maakt	['di 'makt]	['ti 'maːk̆t]	01;08.12
die Marieke gemaakt	['di ma'rikə χə'makt]	['diː 'itə 'mak̟t]	01;09.08
die ook niet	['di 'ok 'nit]	['di' ˌo̟k 'nit]	01;09.08
ook niet	['ok 'nit]	['ʔo'g 'nit]	01;09.08
kijk dan	['kɛik 'dɑn]	['tɛik̆ 'dɑn̲]	01;09.22

Similar to their behavior in onsets, velar stops in codas are targeted for coronal substitution in 70 (49%) of the attempted forms. I illustrate some of these cases in (18).

(18) Coronal substitution of velar stops in codas

buik	['bœyk]	['bœ̟yt]	01;06.01
ook	['ok]	['oːt]	01;06.11
bank	['bɑŋk]	['bɑ'n̲'t]	01;07.15
klok	['klɔk]	['pɔt]	01;09.22
vork	['vɔɹk]	['fɔːt]	01;09.22
broek	['bʀuk]	['but]	01;10.03

Note as well that 67 of these 70 cases (96%) appear on or before age 1;10.03, which suggests a change in the Eva's production strategy for velar stops in coda from the previous time period, during which debuccalization constitutes the leading strategy.

The pattern of coronal substitution affecting velar stops in codas contributes to 34 to the 147 cases of coronal-harmonized forms (23%). Of these 34 apparent coronal harmonies, 21 have C-V identity, with no lexical bias detected.

Aside from the fronting cases discussed above, a production strategy of segmental deletion affects 31 (22%) of the attempted velar stops in coda position. Some examples of these are provided in (19).

(19) Deletion of velar stops in codas

mij ook	['mɛi 'ok]	['m̩ɛijə 'ʔoː]	01;07.22
kijk maar	['kɛik 'maɪ]	['xɛi̯maˑɪ]	01;09.22
die is ook niet heet	['di ˌɪs 'ok 'nit 'het]	['di 'ʔɪ̯soː 'ni 'teːt]	01;11.08
ik naar buiten	['ɪk 'naɪ 'bœytə]	['ʔɪˑ 'naˑ 'bœytə]	01;11.08
oma ook niet	['oma 'ok 'nit]	['ʔoˑmă 'oˑ̯nit]	01;11.08

These deletion cases, however, must also be considered in the larger context: In 28 (90%) of the 31 cases where velar stops are deleted in coda position, the velar stop would have been followed by another consonant within the utterance had it been produced. Based on this observation, we can conclude that the deletion cases can be largely attributed to problems in the production of velar codas followed by onset consonants in the speech stream.

The appearance of velar codas in non-final positions within the utterance also yields 19 cases (13%) where the velar is resyllabified in an onset. All 19 of these cases appear on or after 1;10.03. I illustrate some of these cases in (20).

(20) Target velar codas resyllabified in onsets

wij ook laarzen	['ʋɛi 'ok 'laɪzə]	['ʋɛi 'otə 'la˙s̻ə]	01;10.03
die ook aaien	['di 'ok 'aĭjə]	['di 'joː 'kaiə]	01;11.08
ik heb een lolly-ijs	['ɪk 'hɛpən 'lɔli'ɛis]	['ʔɪkəpə 'lɔ˙li 'ʔɛ̝iʂ]	01;11.08
ik heb ook die	['ɪk 'hɛp 'ok 'di]	['ʔɪˌkɪp 'ʔoː 'di]	01;11.08
ik niet	['ɪk 'nit]	['ʔɪχə 'nit]	01;11.08
ik ook	['ɪk 'ok]	['ʔɪˌko˙k]	01;11.08

A comparison of the data in (18) and (20) thus suggests that at around the age of 1;10.03, Eva was fronting velars syllabified in coda while she produced these consonants in a target-like fashion in onset position, confirming the observation made in section 4.1.1 that velar onsets were on their way to be acquired during the 1;09.08-1;10.03 time period.

In addition to the fronted velars exemplified in (19), two velar stops in coda position undergo labial substitution. Both of these substitutions result in harmonized forms, contributing 3% of the 68 cases of apparent labial harmony. Both of these forms display C-V identity. No firm conclusion can be drawn from this small data set, except that the pattern of labial substitution for velars is fairly marginal.

I move now to a discussion of the generally unproblematic velar continuants in coda position.

4.2.2 Velar Continuants in Codas

As opposed to the velar stops surveyed in the preceding section, velar continuants are virtually unproblematic in coda position. The table in (21) shows a breakdown of production strategies affecting these segments when attempted by Eva.

(21) Behavior of velar continuants in Eva's codas

Attempted Forms	64	
Target-like	50	78%
Deletion	6	9%
Become onsets	4	6%
Other	4	6%

As we can see in (21), out of the 64 attempted forms 50 (78%) are produced by the child as target-like. These cases appear across all ages. Some representative examples of these target-like forms can be seen in (22).

(22) Target-like velar continuants in codas

oog	['oχ]	['oːχ]	01;05.22
dicht	['dɪχt]	['dɪχ̆t]	01;07.15
weg	['ʊɛχ]	['ʊɪχ]	01;07.15
nog een	['nɔχ 'en]	['nɔχeˑn]	01;08.12
Eva aaien toch	['eva 'aijə 'tɔχ]	[ʔefă ʔai 'tɔχ]	01;11.08

There are an additional six cases of segmental deletion affecting velar continuants in coda position. Five of the six cases of deletion appear on or before the age of 1;07.15. Such cases as these can be considered to be early mispronunciations. As discussed by Velleman (1996) and Bernhardt & Stemberger (1999), children often prefer fricatives to be word-final, while they favor stops in onsets. The observations made here about Eva's fricatives match this generalization.

4.3 Interim Discussion

As we saw above, the main production strategy contributing to apparent cases of coronal harmony is one of coronal substitution (velar fronting) targeting velar stops in both onsets and codas. Indeed, velar stops are targeted in 228 (94%) of the 243 cases of coronal substitution affecting velars. As opposed to stops, velar continuants are virtually unproblematic in coda position, produced as target-like 78% of the time.

We also witnessed 34 cases of velar consonant debuccalizations in onsets, 28 (82%) of which affect continuants. As opposed to these, velars continuants in codas are largely unproblematic.

These patterns of coronal substitution and debuccalization are further discussed in chapter 5 from the perspective of default place feature substitution. The asymmetries observed between velar stops and continuants relative to position within the syllable suggest that consonant substitutions are governed by both place and manner of articulation, similar to what was observed in Jarmo's productions. In addition, these production strategies are also governed by position within the syllable. In sum, while velar stops trigger coronal substitution (or velar fronting) in onsets and codas alike, velar continuants trigger debuccalization in onset position but surface as target-like in codas. While a significant portion of the fronting cases contribute to apparent cases of coronal harmony found in Eva's productions, no clear evidence emerged across all of the contexts for feature sharing between consonants and vowels.

Continuing with my investigation of the patterns yielding apparent cases of consonant harmony, I now move on to a discussion of production strategies affecting labial consonants.

4.4 Production Strategies Affecting Labials in Onsets

Beginning with labials attempted in onsets, I provide first a breakdown of these consonants relative to manner of articulation in (23).

(23) Attempted labial onsets in Eva's productions

Attempted Labial Onsets 646	
Labial Stops 452	Labial Continuants 194

As can be seen, 646 labials are attempted in onsets, including 452 stops and 194 continuants. I first discuss the behavior of labial stops in the following section.

4.4.1 Labial Stops in Onsets

In order to attain an overall picture of labial stops in onsets, I provide in (24) a breakdown of the production strategies affecting these consonants.

(24) Behavior of labial stops in Eva's onsets

Attempted Forms	452	
Target-like	387	86%
Coronal Substitution	44	10%
Other	21	5%

As can be seen from the table in (24), labial stops in the child's onsets are virtually unproblematic and are produced as target-like in 387 (86%) of the attempted forms. The target-like forms appear across the entire corpus. I provide some representative target-like examples in (25).

(25) Target-like labial stops in onsets

buik	['bœyk]	['boŭpʷ]	01;06.01
poezen	['puzə]	['puˑsaʔ]	01;06.01
pyjama	[pi'jama ('pjama)]	['pamŭ]	01;06.01
emmer	['ɛməɪ]	['ʔɪmˑɛ]	01;07.22
pandabeer	['pɑndə'beɪ]	['pɑ̰ma'bɪː]	01;07.22
poort open	['poɪt 'opə]	['pɔ̰ː 'topë]	01;09.08
een boot	[ən 'bot]	[ʔən 'buːtʷ]	01;09.22

Although it only represents 10% of the attempted forms, a relatively clear pattern of coronal substitution appears in 44 cases. I provide some representative examples of this in (26).

(26) Coronal substitution affecting labial stops in onsets

muis	['mœys]	['nœys]	01;06.11
plassen	['plɑsə]	['tɑ̱sə]	01;06.11
kapot maken	[ka'pɔt 'makə]	[ˌʔo'pɔtˀ 'naːt̲ʷə]	01;08.12
bijna klaar	['bɛina 'klaɪ]	['tɛinɑ̈ 'taːɪ]	01;09.08
glijbaan	['χlɛiˌban]	['tɛiˌn̥aːnə]	01;09.22

43 of the 44 attestations of this pattern occur before age 1;09.22, which suggests that these examples are representative of an early time period in Eva's phonological development. Also, in 37 of the 44 cases (84%) coronal substitution results in coronal-

harmonized forms. These 37 examples represent 25% of the 147 cases of apparent coronal harmony found in Eva's productions. Out of these 37 harmonized forms, 21 (57%) display place identity between the substituted consonant and the adjacent vowel. No clear lexical bias can be seen through a closer look at these data, which are thus mildly suggestive of feature sharing between consonants and vowels. However, as we will see with labial continuants below, any quick conclusion directly in favor of the partial specification hypothesis based on the trend observed here would be premature at this stage. As alluded to above, I will argue, in chapter 5, that the examples displaying C-V identity in coronal-harmonized forms may be better explained by the special status and high frequency coronal segments in Dutch.

I now turn to a discussion of the labial continuants in onset position, in order to determine whether asymmetries related to manner of articulation such as the ones seen above for velars find correlates in Eva's labials.

4.4.2 Labial Continuants in Onsets

In contrast to labial stops, labial continuants attempted in onsets are more frequently affected by coping strategies. This is also in line with the general preference for stops in onset position discussed above. The table in (27) shows the breakdown of the patterns affecting these consonants.

(27) Behavior of labial continuants in Eva's onsets

Attempted Forms	194	
Target-like	96	49%
Debuccalization	44	23%
Coronal Substitution	22	11%
Stopping	16	8%
Deletion	10	5%
Other	6	3%

Labial continuant onsets are produced as target-like by the child in 96 (49%) of the 194 cases. I provide some examples of these target-like productions, which appear across all ages, in (28).

(28) Target-like labial continuants in onsets

sloffen	['slɔfə]	['pɔfə]	01;04.26
koffie	['kɔfi]	['fiɔfiˑ]	01;07.15
olifant	['oli̯fɑnt]	['ʔoːi̯fɑnt]	01;09.08
Snoopy valt	['snupi 'vɑlt]	['dupi 'ʋaˑut]	01;09.08
vork	['vɔɹk]	['fɔːt]	01;09.22
zwemmen	['zʋɛmə]	['ʋɛ̯mə]	01;11.08

A number of production strategies target labial continuants in Eva's productions. These patterns are in fact similar to those found in Jarmo's productions. First, debuccalization affects 44 (23%) of the attempted labial continuants in onset position. I provide some of these examples in (29). Of these 44 cases of debuccalization, 42 appear on or before the age of 1;07.15.

(29) Debuccalization of labial continuants in onsets

weg	[ˈʊɛχ]	[ˈfi̪χ]	01;04.12
woef	[ˈʊuf]	[ˈhuf]	01;04.12
was	[ˈʊɑs]	[ˈhɑs̪]	01;04.26
fles	[ˈflɛs]	[ˈhɛs]	01;06.01
vogel	[ˈvoχəl]	[ˈʔo̯ŭχə]	01;06.01
vis	[ˈvɪs]	[ˈhi̪s]	01;06.11
vogel	[ˈvoχəl]	[ˈhoːχɔˑ]	01;09.08

Second, in 22 (11%) of the attempted forms, target labial continuants are subject to coronal substitution. Examples illustrating these coronal substitutions are presented in (30).

(30) Coronal substitution of labial continuants in onsets

weg	[ˈʊɛχ]	[dɛχ]	01;04.26
fles	[ˈflɛs]	[ˈdɛs]	01;06.01
kraanwagen	[ˈkʀanʊaχə]	[ˈtaŋˈlʷaˑχə]	01;06.01
vis	[ˈvɪs]	[pˈdɪs]	01;06.01
vliegen	[ˈvliχə]	[ˈjixˑä]	01;06.01
water	[ˈʊatəɪ]	[ˈtɑtʷəː]	01;06.01

Only six (27%) of the 22 coronal substitutions affecting labial continuant onsets result in coronal-harmonized forms. This suggests that the pattern of coronal substitution affecting labial continuants in onset position occurs independently of coronal harmony itself. Of these six coronal-harmonized forms, four display C-V identity, from which no clear hypothesis can be formulated.

Overall, it is also interesting to note that while labials do undergo substitution strategies in onsets, no cases were found in which Dorsal was the substituting feature. This points again to the favored status of coronals as substitute consonants, similar to

what was observed in the sections on velars above and in Jarmo's patterns in the preceding chapter. Turning now to potential effects of position within the syllable, I discuss the fate of labial segments in coda position in the next sections.

4.5 Production Strategies Affecting Labials in Codas

Keeping with the method of data presentation used throughout this chapter, I first provide in (31) the distribution of stops versus continuants in Eva's labial codas.

(31) Distribution of attempted labial codas

Attempted Labial Codas 78	
Labial Stops 63	Labial Continuants 15

As can be seen, Eva attempted a total of 78 labials in coda position, which includes 63 labial stops and 15 labial continuants. I begin with production strategies affecting labial stops in the next section.

4.5.1 Labial Stops in Codas

Labial stops are largely unproblematic in Eva's codas. In (32), I provide a breakdown of production strategies affecting these segments.

(32) Behavior of labial stops in Eva's codas

Attempted Forms	63	
Target-like	53	84%
Become onsets	4	6%
Coronal Substitution	2	3%
Other	4	6%

As can be seen from the table in (32), 53 (84%) of the attempted labial stops are produced as target-like in Eva's codas. I provide some prototypical examples of this in (33).

(33) Target-like labial stops in codas

boom	['bom]	['bo:m]	01;07.22
pap	['pɑp]	['pɑpʷ]	01;08.12
andersom	[ˌɑndəɹs'ɔm]	['ʔɔ̃nʂ̍ʔɔm]	01;09.08
daarop	[ˌda'ɾɔp]	['da:ɹˌɔp]	01;09.08
schaap	['sχap]	['ʂ̍apʷ]	01;09.08
bovenop	['bovə̯ˌnɔp]	['bofˌʔɔp]	01;09.22
op dak	['ɔp 'dɑk]	['ʔɔpˀ 'dɑkʷ]	01;11.08

These target-like productions are found from the earliest speech samples and are consistent throughout the entire sample.

The only two cases of coronal substitution affecting labial stops in coda contribute to the 147 cases (1.4%) of apparent coronal harmony. Neither of these two cases provides evidence for C-V identity. Again here, there are so few examples that no generalizations can be drawn from these data.

4.5.2 Labial Continuants in Codas

As indicated in (31) above, only a few examples of labial continuants in coda position are attempted by the child. The breakdown of production strategies affecting these attempted consonants is listed in (34).

(34) Behavior of labial continuants in Eva's codas

Attempted Forms	15	
Target-like	13	87%
Other	2	13%

Eva's labial continuants are target-like in 13 (87%) of the 15 attempted forms. I provide some of these target-like forms in (35).

(35) Target-like labial continuants in codas

woef	['ʊuf]	['ʔufˑ]	01;04.12
giraffe	[ʒi'ʀɑf]	['hɑ̰f]	01;06.01
slof	['slɔf]	['bɔf]	01;06.01
af	['ɑf]	['ɑf]	01;06.11
hoofd	['fioft]	['oˑf]	01;06.11
af	['ɑf]	['ʔɑf]	01;08.12

No labial continuants were attempted in coda position by the child after age 1;08.12. This gap may in fact be illustrative of the target language itself. Indeed, according to van de Weijer (1998), only 18% of all codas produced in Dutch child-directed speech have the labial place of articulation. Furthermore, only a very small portion (13%) of these labial codas are continuants, which implies that these consonants are found in only 2.3% of the input forms to which the child is exposed.

As we can see from the examples above, similar to velar consonants, when labial consonants undergo place feature substitution, they are in the majority of cases replaced by a coronal. In the following section, I continue my investigation with target coronal segments, in order to uncover the main production strategies contributing to the cases of apparent labial harmony listed in (1).

4.6 Production Strategies Affecting Coronals in Onsets

In Eva's productions, coronals in onsets are largely unproblematic. It is however necessary to examine more closely their behaviors in order to uncover production strategies that yield cases of apparent labial harmony. I provide a breakdown of the patterns affecting coronals in the child's onsets in (36).

(36) Behavior of coronals in Eva's onsets

Attempted Forms	855	
Target-like	572	67%
Debuccalized	71	8%
Stopping	66	8%
Deleted	66	8%
Labial Substitution	55	6%
Other	25	3%

Coronals are target-like in Eva's onsets in 572 (67%) of the attempted cases. I provide some representative examples of this in (37).

(37) Target-like coronals in onsets

deze	['dezə]	['deʂə]	01;04.26
laarzen	['laɪzə]	['l̆aˈʃə]	01;06.01
zitten mama kijk	['zɪtə 'mɑma 'kɛik]	['t̪ɪt̪ə u mą'mɑ̃ etɛit]	01;07.15
doet-ie	['duti]	['tuˌti]	01;08.12
buiten	['bœytə]	['bœ̝ytə]	01;09.08
daar niet	['daɪ 'nit]	['daɪ 'nit]	01;09.08
jam	['ʒɛm]	['tʰɛm]	01;10.03

Although Eva's coronals are target-like the majority of the time, a few patterns also emerge in the data. One such pattern is that of debuccalization, affecting 71 (8%) of the attempted forms. The coronals targeted by this production strategy are most often (72%) part of a consonant cluster. Of the 71 debuccalized forms, 65 (92%) appear on or before age 1;08.12. I provide examples of the pattern in (38).

(38) Debuccalization of coronals in onsets

schoenen	['sχunə]	['ʔumə]	01;04.12
sleutel	['sløtəl]	['hœitəŭ]	01;04.12
vlinder	['vlɪndəɹ]	['ʔɪ̯nə]	01;04.12
drinken	['dʀɪŋkə]	['hɪːn̲ë]	01;04.26
schoen	['sχun]	['ʔyŋə]	01;04.26
schelpen	['sχɛlpə]	['ʔɛ̆upə]	01;06.01
slapen	['slapə]	['haːpə]	01;06.11

The data also reveal a pattern of labial substitution, which affects 55 (7%) of the attempted coronal onsets. Despite the low percentage of the data that these cases account for, I discuss these examples further because some of them result in cases of apparent labial harmony. I provide representative examples of labial substitution in (39).

(39) Labial substitution of coronals in onsets

sloffen	['slɔfə]	['pɔɸə]	01;04.12
schaap	['sχap]	['fa:p]	01;04.26
doen	['dun]	['puŋ]	01;07.15
handschoenen	['ɦɑntsχunə]	[ˌhɑ̆m'bu:nə]	01;07.15
o jee	['o 'je]	[ˌʔo̤ 'ʋe:]	01;07.15
oma toe	['oma 'tu]	['ʔoma 'pu:]	01;07.15
glijden	['χlɛijə (χlɛidə)]	['bɛijə]	01;07.22

51 out of the 55 labial-substituted cases appear on or before 1;08.12. Of these, 28 occur in consonant clusters. Of the 55 cases of labial substitution, 25 cases (45%) result in apparent labial harmony. C-V identity is found in 18 of these 25 cases. However, 15 of these 18 cases come from the child's attempts to produce one word, *sloffen* [slɔfə], which becomes [pɔfə]. We can conclude from this that place sharing between consonants and vowels does not occur in a large portion of the lexical items showing labial substitution.

4.7 Production Strategies Affecting Coronals in Codas

Finally, I conclude my investigation of coronal segments by examining coronals in coda position. The coronals are largely unproblematic in codas, as they were in onset position. In (40), I provide a breakdown of the production strategies affecting these segments.

(40) Behavior of coronals in Eva's codas

Attempted Forms	804	
Target-like	490	61%
Deleted	220	27%
Labial Substitution	41	5%
Become onsets	32	4%
Other	20	2%

As is visible from this compilation, coronal segments are target-like in Eva's codas in 490 (61%) of the attempted forms throughout the corpus. I provide some of these target-like forms produced by the child, in (41).

(41) Target-like coronals in codas

huis ?	['fiœys]	['fiæi̯s̯]	01;04.12
dicht	['dɪχt]	['dɪχt]	01;07.15
wilde hond	['ʊɪldə 'fiɔnt]	['huɑŋ 'ʔɔ̃nt]	01;07.15
poes	['pus]	['pusˑ]	01;08.12
daar niet	['daɹ 'nit]	['daɹ 'nit]	01;09.08
dat	['dɑt]	['dɒˑt]	01;09.08
dat nou?	['dɑt 'nɑu]	['dɑt 'nɑu]	01;09.08
Bert	['bɛɹt]	['vɛt̪]	01;09.22

A pattern of segmental deletion also appears, which affects 220 (27%) of the attempted forms. In 130 of these 220 cases (59%), deletion affects a segment in a consonant cluster within or across words. This pattern manifests itself across all ages and, as such, cannot be related to a specific developmental stage. I illustrate some of these examples in (42).

(42) Segmental deletion of coronals in codas

bal	['bɑl]	['bɑ̟ˑu]	00;08.04
tijger	['tɛiχəɪ]	['tɛ̟iχə]	00;08.04
uil	['œyl]	['ʔɑu]	00;08.04
hand	['fiɑnt]	['haˑnʷ]	01;06.01
hoofd	['fioft]	['oˑf]	01;06.11
dicht doen	['dɪχt 'dun]	['d̪ɪ ˌpuŋ]	01;07.15
paard	['paɹt]	['paː]	01;07.15
dat nou	['dɑt 'nɑu]	['tɑ̟n̪ɑˑu]	01;07.22
Loet boven	['lut 'bovə]	['luˑ 'poːfə]	01;09.22

We also find a patterns of labial substitution affecting 41 (5%) of the coronals in coda position. I provide some representative examples of this in (43).

(43) Labial substitutions affecting coronals in codas

poes	['pus]	['puf]	01;04.12
brood	['bʀot]	['boːp]	00;08.04
microfoon	[ˌmikʀo'fon]	['hʌ̆m̩]	01;02.05
nijlpaard	['nɛilˌpaɹt]	[ʊaːpʷ]	01;07.15
kachel	['kɑχəl]	['tɑˈχʷoːm̩̆]	01;07.22
mes	['mɛs]	['ʊɛːf]	01;08.12
panda	['pɑnda]	['pɑma]	01;09.08

34 of these 41 cases of labial substitution result in labial-harmonized forms, accounting for half (50%) of the 68 cases of apparent labial harmony. Out of these 34 cases, 15 display C-V identity. However, an obvious lexical bias coming from two words can be found within these data. First, the word *panda* [pɑnda], realized as [pɑma], accounts for 17 of the 34 cases. Second, the word *poes* [pus] becomes [puf] in nine cases. It is thus difficult to draw reliable conclusions based on the remainder of this data set.

In sum, coronal segments appear on the surface to be virtually unproblematic. Although the majority of the attempted coronal forms are produced as target-like by the child, some production strategies affect the segments, such as debuccalization, deletion, and labial substitution, the latter of which often results in labial-harmonized forms.

I provide in the next section, a more in-depth discussion of the patterns visible in Eva's productions that result in apparent consonant harmony.

5. Discussion

In this section, I discuss the patterns that result in apparent labial, coronal, and dorsal harmony. First, I discuss the patterns affecting coronals and velars which result in cases of apparent labial harmony. Second, I discuss patterns appearing with velars and labials resulting in cases of apparent coronal harmony. Finally, I briefly discuss the rather marginal cases where coronals are affected producing velar- harmonized forms. I then discuss these apparent harmony cases in light of the partial specification hypothesis. This discussion is primarily based on the proportions of harmonized forms that display C-V identity across the data set. I first look at labial-harmonized forms in the next section.

5.1 Apparent Cases of Labial Harmony

As reported in (2), 68 cases of apparent labial harmony are attested in the corpus. The table in (44) provides the distribution of these forms according to the production strategy causing the form to become harmonized. Because several of these words have substitutions affecting both onset and coda segments, there are often more cases of

segmental substitutions than there are words affected. For the sake of clarity, I list the segmental substitutions in a column separate from the number of words affected by each production strategy. See Appendix B1 for detailed list of apparent cases of labial harmony.

(44) Production Strategies contributing to apparent cases of labial harmony

Production strategies resulting in apparent labial harmony	**Apparent consonant harmony**
Labial substitution affecting coronal stops in onsets	5
Labial substitution affecting coronal stops in codas	24
Labial substitution affecting coronal continuants in onsets	20
Labial substitution affecting coronal continuants in codas	9
Insertion of a labial segment before a coronal coda [pus] → [puɸs]	1
Labial substitution affecting velar stops	5
Labial substitution affecting velar continuants	4
Total apparent labial harmony	**68**

Although there are many cases of labial substitutions that do not result in labial-harmonized forms, the vast majority of these labial-harmonized forms, 58 out of 68 (85%) come from cases of labial substitutions targeting coronals. These cases can be divided evenly between target stops and continuants. Labial substitutions are also shared across positions within the syllable, with 25 cases targeting coronals in onsets and 33 affecting coronals in codas. Most of the remaining cases affect velars (nine cases, seven in onsets and two in codas). Finally, one isolated case is found where a labial segment is inserted before a coronal coda, resulting in a labial-harmonized form.

Coronal continuants are targeted in 29 cases by a pattern of labial substitution resulting in labial-harmonized forms. Of the labial-harmonized forms, 20 target coronal continuants in onsets, 15 of which (75%) display C-V identity. 14 of these 15 cases come from the words *slof* [slɔf] and *sloffen* [slɔfə]. All of these cases appear on or before age 1;07.22. Labial substitution affects coronal continuants in codas in 10 cases, nine (90%) of which also display C-V identity. However, all nine of these come from the word *poes* [pus] and appear on or before the age of 1;06.01. Finally, five cases of labial substitution target coronal stops in onset position. Three of these five (60%) display C-V identity. In addition, 24 coronal stops in coda position undergo a pattern of labial substitution resulting in labial-harmonized forms. Six of these (25%) display C-V identity. These cases undermine any prediction based on the partial specification hypothesis.

The evidence from all of the contexts discussed here suggests that at best, the coronal substitutions seen here with C-V identity emerge as a coincidence of a series of independent factors. This hypothesis is also supported in the context of coronal-harmonized target velar segments, which are investigated next.

5.2 Apparent Cases of Coronal Harmony

As already stated above, 147 cases of apparent coronal harmony are attested in the Eva corpus. The table in (45) provides a breakdown of the production strategies resulting in these coronal-harmonized forms. See Appendix B2 for detailed list of apparent cases of coronal harmony.

(45) Production strategies contributing to apparent coronal harmony

Production strategies resulting in apparent coronal harmony	**Substitution**	**Apparent consonant harmony**
Coronal substitution affecting velar stops in onsets	70	102[5]
Coronal substitution affecting velar stops in codas	34	
Coronal substitutions affecting velar continuants in onsets	6	
Coronal substitutions affecting labial stops in onsets	37	45
Coronal substitutions affecting labial stops in codas	2	
Coronal substitutions affecting labial continuants in onsets	6	
Apparent cases of coronal harmony	**155**	**147**

If we combine all of the cases of coronal substitution compiled in the data breakdowns above (in examples (6), (10), (16), (24), (27) and (32)), we end up with a total of 302 cases of coronal substitution. These substitutions result in 147 words displaying apparent coronal harmony. The proportion of coronal substitutions thus largely exceeds the number of cases of coronal-harmonized forms resulting from it. This strongly suggests that substitution happens independently of any requirement for place feature harmony in output forms.

Focusing first on the substitutions affecting velars, these substitutions result in 102 coronal-harmonized words, eight of which display substitution in both onset and coda positions, for a total of 110 substitutions. 70 of these substitutions target velar stops in onset position, 34 affect velar stops in coda position and six affect velar continuants in onsets.

Turning now to coronal substitutions affecting labial consonants, this pattern results in 45 words displaying coronal harmony. Of these 45 cases, 37 come from labial

[5] Eight forms have substitution in both onsets and codas but result in only eight harmonized forms.

stops in onset position, six from labial continuants in onset position and two from labial stops in codas.

On the face of it, the cases of coronal substitution affecting labials appear to be highly correlated with C-V identity. Of the 37 existing cases of coronal substitution affecting labial stops in onsets, 28 (76%) display C-V identity. Also, there appears to be no lexical bias. While this observation could a priori be taken as evidence for the partial specification hypothesis, it must be noted as well that these cases are attested from the earliest up to the latest recording sessions, suggesting that there are no developmental stages related to this substitution strategy. In addition, as will be discussed in chapter 5, given the frequency of coronal consonants and vowels in Dutch, it is plausible that this outcome (coronal consonants and vowels appearing in the same word) is itself an artifact of the high frequency of these segments in the language. This possibility is also supported by the fact that out of the more marginal patterns listed in examples (24) through (34), no clear pattern of C-V identity was detected.

Similar to coronal substitutions affecting labials, the ones affecting velars appear to be independent from any process of lexical specification triggering harmony itself. Out of the 70 cases where coronal substitution targets velar stops in onsets producing coronal-harmonized forms, only 37 cases (53%) show C-V identity. If the partial specification hypothesis held true, one would predict a much higher proportion of these cases. The same applies to coronal-harmonized velar codas, which display place identity with the preceding vowel in 21 of the 34 cases (62%). Out of six cases of coronal-harmonized velar continuants in onsets, four (67%) show C-V identity. With percentages of C-V

identity in coronal substituted forms hovering around the 60% range, these examples do not provide strong support for the partial specification hypothesis.

Finally, the relationship between segmental substitution and manner of articulation should not be neglected either. Indeed, we observed in the data that both labial and velar continuants in coda tend for the most part not to be affected by coronal substitution. While this relates to the favoring of stops in onsets and continuants in codas discussed by Velleman (1996) and Bernhardt & Stemberger (1999), this also implies that the substitution strategies are not triggered by a lack of feature specification, which should affect all consonants across all manners of articulation. Rather, this asymmetry suggests that the patterns of substitution resulting in coronal-harmonized forms relate to constraints on the place and manner feature combinations allowed by the child's phonology in different positions within the syllable.

Chapter 5 - General Discussion

1. Introduction

In this chapter, I discuss one central issue that arose in my discussions of the patterns found in the preceding chapters in light of related evidence documented in the scientific literature. This issue relates to the special status of the Coronal feature evidenced in both Jarmo's and Eva's data. As was evident from chapter 3 (on Jarmo's data), the most widespread production problem lies in attempted labial continuants in onset position. For Eva, in chapter 4, the production difficulties were most often caused by velar segments attempted in both onsets and codas. Although the production problems were fairly different, the children chose very similar coping strategies. Indeed, both of them favoured a production strategy whereby the problematic segment undergoes a process of coronal substitution. This production strategy often results in apparent cases of coronal harmony, many of which display C-V identity.

First, I discuss this pattern of coronal substitution by making reference to the special status of coronals universally in section 2. In section 3, I discuss the special status of coronals in Dutch, from the perspective of consonant and vowel inventories, the distribution of the segments within prosodic positions, and the frequency of occurrence of the segments in the ambient language. Finally, I provide a summary of the discussion in section 4.

2. The Special Status of Coronals Across Languages

Coronal consonants have a special status across languages. For example, the contributors to Paradis and Prunet (1991) present several arguments to the effect that across languages coronals are essentially different from other consonants. These arguments include the status of coronals in assimilation and neutralization processes, their behavior as transparent segments, and their frequency of occurrence. First, Paradis and Prunet (1991) state that coronals tend to be assimilated segments in both adjacent and nonadjacent assimilations. They state that there is a tendency for complex segments to be simplified to coronals in coda position. For example, the Korean neutralization of palatals to dentals in coda position, reported by Cho (1988: 49) suggests that dentals are less complex than palatals. Coronals therefore appear to be the more simple segments because they are often the outcome of neutralization processes.

Second, transparency effects can be found where vowel spreading can take place across coronals but is blocked across non-coronals. These transparency effects can be seen, for example, in patterns of sibilant harmony in Chumash (Shaw 1991). Finally, as reported by Paradis and Prunet (1991), coronals are also special in that they are typically the most frequent consonants found across languages. There are three ways in which coronals may display higher frequency. The inventory frequency is "the number of coronals in the consonant inventory of a given language (in comparison with the number of other consonants in the same inventory)." Typological inventory frequency is "the number of coronals attested in a universal phonemic inventory (in comparison with all other attested consonants in the same inventory)." Finally, occurrence frequency is "the

number of times coronals are produced in a representative speech corpus (in comparison with the number of times other consonants are produced in the same corpus)" (Paradis and Prunet 1991: 11).

As we will see in the following section, these criteria are generally met in Dutch.

3. The Special Status of Coronals: Dutch

Coronal consonants indeed have a special status in Dutch. This special status is made evident in this section through a look at the frequency and distribution of coronal segments in the language. First, I examine the consonant and vowel inventories of the language to determine whether coronals display higher frequency in the phonemic inventory. Second, I look at the distribution of coronals within prosodic (syllable) structure. Finally, I look at the occurrence frequency of coronal segments through a study of adult input.

3.1 Frequency of Consonants and Vowels in the Phonological Inventory

In order to determine whether the inventory frequency provides evidence for a special status of coronal in Dutch, I examine the consonant and vowel inventories of the language. The table in (1) presents the consonant inventory of Dutch.

(1) Consonant inventory in Dutch (Booij 1995: 7)

	Bilabial	Labio-dental	Alveolar	Palatal	Velar	Glottal
Plosives	p,b		t, d		k, (g)	
Fricatives		f, v	s, z		x	h
Nasals	m		n		ŋ	
Liquids			l, r			
Glides		ʋ		j		

According to Booij (1995), the consonantal inventory of Dutch includes six labial consonants, eight coronal consonants, and five velar consonants. Although, there are slightly more coronal consonants than other places of articulation, no clear dominance for the coronals is evident from this inventory. However, evidence for such a dominance can be found in the Dutch vowel inventory, provided in (2).

(2) Vowel inventory in Dutch (Booij 1995: 4)

	Front	Central	Back
Lax Vowels	ɪ, ɛ, ʏ	ɑ	ɔ
Tense Vowels	i, y, e, ø, a		u, o
Schwa		ə	
Diphthongs	ɛi, œy		ɔu

It is clear from the vowel chart in (2) that there are many more front (coronal) vowels than central or back vowels. Adhering strictly to the criteria for vowel place of articulation discussed in section 2, ten vowels can be considered coronal (front), as opposed to only two dorsal (central unrounded) and four labial (back round) vowels. This inventory has two implications with regard to the status of coronal vowels in the

language. First, from the perspective of the phonological inventory, there are many more coronal vowels than any other types of vowels together. Under the hypothesis that the shape of segmental inventories plays a role in developing phonologies, we expect this fact to play a role in Dutch child language. Second, because coronal vowels are dominant in the inventory, we expect these vowels to appear more frequently in the words attempted by the child. When this fact is considered from the perspective of C-V interaction, the implication is that there is a greater chance for words that undergo coronal substitution or coronal harmony to also display C-V identity. We observed this tendency in both case studies covered in this thesis.

Beyond inventory, however, we expect the most significant impact of frequency to come from tendencies found in the input to which the child is exposed. For example, if it were the case that coronals were not occurring more frequently than segments with other places of articulation, the facts noted about the Dutch phonological inventory above would presumably have only a marginal effect on the children's grammar. This is however not the case; coronals are indeed very frequent in the language, as discussed below.

3.2 Frequency of Occurrence in the Ambient Language

In Dutch there is a high occurrence of coronal segments. Van de Weijer (1998) provides the results from a study during which he collected high density samplings of speech input from adults to determine the frequency of occurrence of individual consonants that are heard by an infant on a daily basis. The infant participating in van de

Weijer's study is a female monolingual Dutch learner who was six months old at the beginning of the study. She belongs to a family with two parents and an older sister. The infant was accompanied by a recording device during all of her waking hours for three months, which was used to determine the phonological properties of speech she was hearing on a daily basis.

One of the main observations that arise from this study is that coronal consonants emerge as the single most prominent category of consonants in the language. As alluded to above, one would expect from the vocalic inventory in (2) to also find coronal (front) vowels to be extremely frequent in the language. Unfortunately, van de Weijer does not report on such frequencies. Nonetheless, the main focus of this discussion is on the special status of coronal consonants, i.e. the consonants that act as the main substitutes in both Jarmo's and Eva's outputs. In line with this observation, coronals are indeed extremely frequent in the ambient language.

Van de Weijer (1998) looked at consonants in syllable onsets and offsets from three different speech contexts, adult-to-adult, adult-to-child, and adult-to-infant. The results of this study are illustrated in (3). This table details the occurrence frequency of consonants in the onsets and offsets (codas and right appendices; see further below) across the three speech contexts studied by van de Weijer.

(3) Occurrence frequency of consonants in Dutch (van de Weijer, 1998)

Frequency	Labial	Coronal	Velar
Adult-Infant onsets	29%	61%	10%
Adult-Child onsets	35%	53%	12%
Adult-Adult onsets	33%	57%	10%
Adult-Infant offsets	9%	78%	13%
Adult-Child offsets	18%	71%	11%
Adult-Adult offsets	8%	76%	17%
Average frequency	**22%**	**66%**	**12%**

As is evident from these data, coronal consonants display strikingly higher frequencies of occurrence in both onsets and offsets for adult speech directed at the infant, her sister and other adults. It is in the syllable offsets that coronal frequencies are the highest, accounting for approximately three quarters of the data. Because syllable offsets typically license material that is less marked than what onsets typically license, this provides strong evidence to the child for the unmarked status of coronals in the language.

In addition, vowel frequency data from Dutch also suggest a special unmarked status of coronals in the language. The table in (4) illustrates the average occurrence frequency of vowels by place of articulation as described by van de Weijer (p.c.: August 2006).

(4) Frequency of occurrence of vowels in Dutch (van de Weijer, p.c.: August 2006)

Place of Articulation	Labial	Coronal	Velar
Average Frequency	26%	44%	30%

In order to not bias the interpretation of these vowel frequency data, schwa (ə) has been excluded since it is not representative of any particular place of articulation. As see can

see in (4), the coronal vowels are not as frequent as coronal consonants in Dutch, however, the coronal vowels are the most frequent vowel type, representing nearly half of the vowels. Therefore vowel frequency information is in line with that of coronal consonants as a favored place of articulation.[6] If the child needs to resort to a default place feature for consonants and vowels alike, this evidence makes coronals be the most likely choice.

In the next section, I provide further support for the unmarked nature of coronal consonants in Dutch through looking at the distribution of these consonants within the syllable.

3.2 Distribution of Coronal Consonants

As reported by Fikkert (1994: 43-49), coronals also have a special status within the syllable in Dutch. Indeed, consonant clusters found syllable-initially and syllable-finally in the language obey a series of constraints governing the sonority and place features of the segments involved. Skipping all of the details that pertain to the core syllable in Dutch (the interested reader can consult works by Booij 1981, 1984, 1995, Trommelen 1983, van der Hulst 1984, 1985, Kager and Zonneveld 1986, Kager, Visch and Zonneveld 1987, van der Hulst and van Lit 1987, Kager 1989 on this topic), I will restrict myself to the status of appendices in the Dutch syllable.

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[6] This observation about Dutch vowels is relevant to my study and that of Fikkert and Levelt. It predicts children's tendency to substitute non-coronal vowels for coronal vowels in produced forms. However, the issue of vowel production in Dutch-learning children lies outside the scope of this thesis and thus is left for further research.

At the left edge of the syllable, tri-consonant clusters (e.g. [str]) can only begin with the coronal consonant [s]. This in itself points toward a special status for coronals, something also observed in the left appendices found in other West-Germanic languages (see Goad and Rose 2004 for a discussion of left-edge clusters in this language family and in acquisition). At the right edge of the syllable, up to three consonants can appear in the appendix, as long as these consonants are all coronal. Again here, these consonants provide evidence for coronals as being unmarked in the language. This point about the exceptionality of the coronals in this language is further supported by the fact that appendix positions are the only ones that allow for violations of the Sonority Sequencing Generalization (e.g. Sievers 1881, Jespersen 1922, Clements 1990).

Under the hypothesis that the child is aware of phonotactics such as these, one can suppose that coronals will be analyzed as unmarked, a hypothesis that appears to be supported by the substitution strategies observed in both Jarmo's and Eva's outputs.

4. Discussion

Consonant harmony seems to manifest itself in different ways across languages. The evidence in this thesis, especially in light of the potential influence of language-specific properties that play a role in children's production strategies when dealing with difficult sounds and sound combinations, may itself provide an explanation for the cross-linguistic differences ovserved. The facts reported above clearly suggest that coronal consonants are unmarked both universally and in Dutch. All these facts conspire to predict that if the child were to select a default place of articulation, coronal would be the

most likely option. This prediction appears to be borne out in the evidence unveiled in the preceding chapters which highlights coronal substitution as the favored strategy used by the two children to cope with different production problems. Indeed, although the problems encountered by the children are fairly different in nature (both in terms of the featural content of the problematic consonants and of the syllable position within which they undergo substitution), they utilize a common strategy, that of coronal substitution. This strategy, which is well motivated through the special status of coronals discussed above, linked with the distribution of coronal vowels and consonants in the target forms attempted, often results in similar apparent cases of coronal harmony with an intervening front vowel.

As such, the apparent feature sharing seen in the coronal substitution patterns (save the real case of coronal harmony uncovered in Jarmo's corpus and discussed in section 5 of chapter 3) is likely an artifact of the general phonotactics of the Dutch language, which correspond with the universal unmarkedness of coronals, and with the children's interpretation of these phonotactics in their development of alternative production strategies for segments that pose problems in their phonology.

Chapter 6 - Concluding Remarks

In this thesis, I addressed two pressing questions in the field of phonological acquisition. The first of these pertains to the origin of consonant harmony as we find it in child language, a process which has no correlates in adult languages. Tackling this issue, I investigated the driving forces behind consonant harmony as a process. This investigation uncovered a series of production strategies that result in harmony even though these patterns are independent from harmony itself. The empirical focus of the investigation, speech productions from Dutch-learning children, was set by the fact that consonant harmony data in Dutch seems different from that for other languages studied to date (e.g. English, French). Indeed, rather than appearing to be a process of interaction between consonants at a distance, on the face of it, consonant harmony in Dutch looks more like feature sharing between consonants and adjacent vowels. According to the partial specification hypothesis proposed by Levelt (1993, 1994, 1996) and subsequently developed by Fikkert and Levelt (2004, 2006), this identity between consonants and vowels emerges from the fact that a given lexical item is assigned only one place feature and that this place feature is shared between the consonants and vowels in surface forms. As mentioned in section 4.1, this proposal implies that C-V identity should be found in early forms only, under the necessary assumption that lexical items are more richly-specified at later developmental stages.

In order to address these issues, I looked at individual case studies of two of the children (Jarmo and Eva) whose productions were examined in the original study of

consonant harmony in Dutch by Levelt (1994). The investigation required a complete recompilation of these children's data and a subsequent reanalysis based on the new compilations. I looked at the data from from both qualitative and quantitative perspectives in order to provide a representative account of production strategies emerging in the children's outputs. First, I addressed each of the cases of apparent consonant harmony from the perspective of the place of articulation of the consonants targeted by the harmonizing processes. I then examined all attempted cases of these targeted segments, in order to determine the extent to which the patterns yielding harmony could affect these consonants, even in output forms that did not display harmony. At each step of this investigation, quantitative data were also collected in order to report on the representativity of the qualitative assessments. In other words, I characterized each production strategy identified from the perspective of the types of consonants it targeted, and characterized each target consonant type from the perspective of the production strategies affecting it. Each pattern was then analyzed as being an inherently harmonizing process or as being a harmonizing process by accident, due to other independent factors involved. Finally, throughout the investigation, I discussed the proportion of the forms showing C-V identity, keeping in mind a potential role for partial specification, under the expectation that it should manifest itself in early word productions.

As a general result, this study uncovered a series of patterns, most of which are independent from consonant harmony itself, but that result in harmonized forms. The independence of these patterns is supported by the observations that, first, these

production strategies often manifest themselves in contexts that do not result in harmony —as such, we cannot describe them as inherently-harmonizing processes— and second, in several cases the problematic consonants undergoing these production strategies of place substitution could also undergo alternate production strategies such as consonant debuccalization or stopping. This is especially evident from Jarmo's data on labial continuants.

Only one clear pattern suggesting genuine consonant harmony was found in the data. This pattern, one of coronal harmony, is attested in Jarmo's productions. It targets labial stops [p, b, m] in onsets only. It is triggered exclusively by the consonant [t] in codas (as opposed to all coronals in codas) and is independent from the quality of the vowel intervening between the two harmonizing consonants. Finally, it manifests itself within a self-contained grammatical stage that spans over a period of approximately three and half months. All of these observations are suggestive of a real process of consonant harmony.

Beyond the cases of segmental substitution and consonant harmony, one encompassing generalization was attained from a comparison of the two case studies, both of which reveal the peculiar behavior of coronal segments in patterns of segmental substitution. First, for both children, many more cases of apparent coronal harmony are found than cases of labial or dorsal harmony. In addition, the apparent cases of coronal harmony found in both corpora show the highest rate of C-V identity compared with the other apparent cases of harmony. For both children, the majority of the observations are related to patterns of substitution of consonants whose production poses problems. In the

Jarmo corpus, the most prominent production problem yielding segmental substitution relates to labial continuants in onset position. However, this problem was not an important one in the Eva corpus. For Eva, the main problem lies in the production of velar segments in both onsets and codas. Although the nature of the two production problems is fairly different (different places and manners of articulation involved; different positions affected by the substitutions), the strategies used by children when attempting to produce the segments are very similar. Indeed, the substitute (default) consonant to replace labial continuants for Jarmo and velars for Eva is generally coronal.

I argued that the sources of most of these observations about the peculiar behavior of coronals in the data can be found within the target forms attempted by the children, which reflect prominent properties of Dutch phonology. Many of the coronal substitutions in onsets occur in words that have coronals in codas. Likewise, many of the vowels adjacent to affected consonants in these words are already front vowels. Focusing specifically on coronal consonants, it must be noted that these consonants have a special status across languages, in which they display relative unmarkedness. This observation is well supported in the phonological and statistical properties of Dutch. First, coronal (front) vowels are more prominent in the vowel inventory of Dutch, which contains ten coronal (front) vowels, as opposed to four back vowels and two central vowels. Second, consonants display several properties that predispose coronal to be the default place of articulation in the language. At the level of syllable structure, coronals are the only consonants that can appear in left and right appendix positions, within which they are not subject to sonority restrictions. Also, from a frequency perspective, coronal consonants

are highly predominant in the language; they appear more frequently than any other types of consonants combined in both syllable onsets and offsets. The predominant presence of front (coronal) vowels and the distribution and frequency of coronal consonants in the language,conspire to yield a high number of apparent cases of coronal harmony with front vowels.

In light of this, the data do not provide much support for the hypothesis that consonant harmony results from partial specification of lexical items. Indeed, many of the patterns that would appear at first glance to support this hypothesis result from lexical items that display a high frequency of occurrence in the corpora. Also, several of these patterns occur in relatively late productions, that is during time periods when partial specification is expected to no longer manifest itself. However, note in this respect that because the current investigation was not focusing on the early portions of the corpora only, it is very plausible that the generalization attained by Levelt (1993, 1994, 1996) and Fikkert and Levelt (2004, 2006) still holds. Thus, this thesis can in no way be taken as contradicting the partial specification hypothesis. It however raises the question as to whether there exist relationships between early production strategies and the substitution strategies observed at later time periods. For example, is it possible that partial specification applies each time a new word is learned, even after the first stages in phonological development have taken place? This issue is left for further research.

In order to fully compare the results in this thesis with those in Fikkert and Levelt's research, a future developmental study of the recompiled data is needed. In addition, it must noted that this study is based on productions of two children only. No

independent evidence is available to suggest that the generalizations attained in this research can be extended to the other ten children from the Dutch corpus. This empirical question too leaves room for future research, to determine whether other children in the corpus follow similar or different patterns of production strategies. In addition, this type of research could be extended to other languages in order to determine whether consonant harmony is indeed a process of it own or an artifact of other production strategies such as that of segmental substitution found here.

In conclusion, this study, like many others, leaves more questions than answers. It however reveals interesting relationships between production strategies adopted by children and phonological and statistical properties of the target language. As such, it suggests that consonant harmony, an inherently intriguing process, can emerge from a series of different factors, instead of as a grammatical requirement for harmony in output forms.

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Appendix A: Jarmo - Apparent Consonant Harmony

Appendix A1: Apparent Cases of Labial Harmony

(1) Apparent Labial harmony targeting coronals in onsets

01;07.29	auto	['oto]	['bipɑ]
01;11.06	tok tok tok	['tɔk ˌtɔk ˌtɔk]	['ʊɔpɔpɔpʰ]
02;00.04	toktok	['tɔk'tɔk]	['po̤po̤]
02;02.27	tandenborstel	['tɑndəˌbɔɹstəl]	['bɑmˌpɔfɔ̆ʊ̆]
02;04.01	giraf	[ʒʲi'ʀɑf]	['blɔfkë]
01;07.15	trommel	['tʀɔməl]	['pɑba]
02;00.28	ballonnen	[ˌbɑ'lɔnən]	['pɑmä]
02;01.08	meenemen	['me'nemən]	['meˌmeme]
02;04.01	giraf	[ʒʲi'ʀɑf]	['blɑ̤fk͡jə]
01;10.09	paula	['pɑula]	['povə]
01;10.09	paula	['pɑula]	['bovɛ]
01;10.09	paula	['pɑula]	['pʊovɑ]
01;11.06	paula	['pɑula]	['povə]
01;11.06	paula	['pɑula]	['bova]
01;11.06	paula	['pɑula]	['bovä]
01;11.20	paula	['pɑula]	['bova]
02;00.04	paula	['pɑula]	['pɑuvə]
02;00.04	paula	['pɑula]	[ˌpɑu'vɔ]
02;00.04	paula	['pɑula]	[ˌpɑu'va]
02;00.04	paula	['pɑula]	['boʊ̆va]
02;00.04	paula	['pɑula]	['bova]
02;00.04	paula daar	['paula 'dar]	['povə 'da]
02;01.08	paula	['pɑula]	['pɔvɑ]
02;03.09	clown nog een clowntje	['klɑun 'nɔχən 'klɑuntjə]	['kuvɑ̆ 'mɔ 'kvɑ̤mcʉ]
01;10.23	slapen	['slapə]	['papə]
02;01.22	slab uit	['slɑp 'œyt]	['pɑpə 'ʔɑut]
02;02.06	bellen	['bɛlən]	['bɑvə]

(2) Apparent labial harmony affecting coronals in codas

01;08.26	boot	['bot]	['pʊŭf]
01;09.09	maan	['man]	['mɔm]
02;03.09	clown nog een clowntje	['klɑun 'nɔχən 'klɑuntjə]	['kuʊŭ 'mɔ 'kʊa̲mcʉ]
01;09.09	maan	['man]	['mɒm]
01;09.23	bad	['bɑt]	['bëp]
01;09.23	bad	['bɑt]	['bɑp]
01;09.23	haan	['han]	['mam]
01;10.09	paard hier	['part 'hir]	['pap 'hiə]
01;10.09	paard hier	['part 'hir]	['pap 'hiɪ]
02;02.27	tandenborstel	['tɑndə¸bɔɪstəl]	['bɑm¸pɔfɔŭ]
01;07.29	bal	['bɑl]	['pɑuw]
01;09.09	appel	['ɑpəl]	['ʔɑpɔʊ]
01;10.09	bal	['bɑl]	['boʊ]
01;10.23	bal	['bɑl]	['pɑuw]
01;11.06	appel	['ɑpəl]	['ʔɑpɔw]
02;01.22	bal	['bɑl]	['pɑuw]
02;01.22	kameel	[¸ka'mel]	['teŭw]
02;02.06	lepel	['lepəl]	['depow]
02;02.06	schommel	['sχɔməl]	['homow]
02;02.27	appel	['ɑpəl]	['ʔɑpŭw]
02;03.09	appel	['ɑpəl]	['ʔɑpɔm]
02;03.09	een kameel	[ən ¸ka'mel]	[ʔə'meŭw]
02;03.09	kameel	[¸ka'mel]	['meuw]
01;07.15	bal	['bɑl]	['pɑw]
01;08.12	bal	['bɑl]	['bɑɸ]
01;08.26	bal	['bɑl]	['ba:f:]
01;10.23	bal	['bɑl]	['bɑʊ]
01;10.23	bal	['bɑl]	['pɑʊ]
02;02.06	nee Selma	['ne 'sɛlma]	['neĭ 'nɛwma]

(3) Apparent labial harmony affecting velars in onsets

01;11.06	vogel	['voχəl]	['ɸo̞w]
01;11.20	schildpad	['sχɪl̩pɑt]	[ˌpʉ'tɑp]
02;03.09	trommel	['tʀɔməl]	['tʊɔmë]

(4) Apparent labial harmony affecting velars in codas

01;09.09	monkey	['mɔŋki]	['mɔm̩]
01;09.23	monkey	['mɔŋki]	['mɔmü]
01;10.09	boek	['buk]	['bup]
01;11.06	tok tok tok	['tɔk ˌtɔk ˌtɔk]	['ʊɔpɔpɔp^{h}]

(5) Apparent labial harmony caused by reduplication

02;04.01	olifant deze	['oli̩fɑnt 'dezə]	['ʔofɑ̃ˌfɑ̃ 'deˑs]

Appendix A2: Apparent Cases of Coronal Harmony

(1) Apparent coronal harmony affecting labial stops in onsets

01;11.20	poesje	['puʃə]	['tuʃə]
01;11.20	zebra	['zebʀa]	['tetaˑt]
02;01.08	bril	['bʀɪl]	['tʊɪl]
02;01.08	zand spelen	['zɑnt 'spelən]	['tɑm ˌteːlə]
02;01.22	dat ook stukmaken	['dɑt 'ok 'stɯkmakən]	['tɑ ʔo 'tysˌtakə]
02;01.22	muisje	['mœyʃə]	['tœyχ͡jə]
02;01.22	muisje	['mœyʃə]	['tɑuwʃə]
02;02.06	poes eten	['pus 'etən]	['tuʃ̆ə ʔeːtə]
01;07.29	paardje	['paɪtjə]	['taːti]
01;11.06	beertje	['beɪtjə]	['tiˑt͡jə]
01;11.20	boot	['bot]	['tlɔt]
01;11.20	hier kapot	['hir ˌkɑ'pɔt]	['hiə 't͡jɔt]
01;11.20	kapot	[kɑ'pɔt]	['dɔ̰t]
01;11.20	kapot	[kɑ'pɔt]	['tɔt]
01;11.20	nijlpaard	['nɛilˌpaɪt]	['dat]
01;11.20	paard	['paɪt]	['taˑt]
01;11.20	schildpad	['sχɪlˌpɑt]	['t̪itaːt]
01;11.20	schildpad	['sχɪlˌpɑt]	['teitat]
01;11.20	tandenborstel	['tɑndəˌbɔɪstəl]	['tɑtət͡jut/tɯ]
02;00.04	bad	['bɑt]	['taˑt]
02;00.04	boot	['bot]	['toˑt]
02;00.04	paard	['paɪt]	['taˑt]
02;00.04	paardje	['paɪtjə]	['tat͡jɪ]
02;00.28	bad	['bɑt]	['tɑ̰t]
02;00.28	buiten	['bœytən]	['tœytə]
02;01.08	alsjeblieft	['ɑlʃəˌblift]	[ˌʔɑsi'tist]
02;01.08	alsjeblieft	['ɑlʃəˌblift]	[ˌʔhɑ't͡jit]
02;01.08	blaadjes	['blat͡jəs]	['tlat͡jəs]
02;01.22	grote poten	['χrotə'potən]	['tot 'totə]
02;01.22	kleine poten	['klɛinə 'potən]	['tɛi 'tot͡jə]
02;01.22	muts	['mœts]	['tytst]
02;02.06	daar slabbetje	['daɪ 'slɑbət͡jə]	['tɑ̰ 'tɑtcə]
02;03.09	dag beertje	['dɑχ 'beɪt͡jə]	['dɑχ 'dɪ̰sə]
01;04.18	damespaard	['daməsˌpaʀt]	[ʔɑːʔɯˌd͡jaːi]

01;07.15	paard	['paɹt]	['ta]
01;11.20	schildpad	['sχɪl̩pɑt]	['ʔitaːt]
02;00.04	tandenpoetsen	['tɑndənputsən]	['tapu̯tutə]
02;03.09	borstel	['bɔɹstəl]	['lo̯utoʊ̯]

(2) Apparent coronal harmony affecting labial continuants in onsets

01;07.29	vliegtuig	['vliχtœyχ]	['titɑ]
01;09.09	vis	['vɪs]	['s̪iʃ̺]
01;09.23	duiven	['dœyvən]	['dœ̟ysə]
01;09.23	fietsen	['fitsən]	['l̪iʃə]
01;11.20	mama's fiets	['mɑmas 'fits]	['mɑmɑ 'tiʃə]
01;11.20	vis	['vɪs]	['teɪs̪]
01;11.20	vis	['vɪs]	['tɪs̪]
01;11.20	willy	['ʋɪli]	['nɪʋli]
01;11.20	willy	['ʋɪli]	['lɪli]
02;00.04	fiets	['fits]	['titə]
02;00.04	fiets	['fits]	['tits]
02;00.04	fiets (van) mama	['fits vɑn 'mɑmɑ]	['tic 'mɑmɑ]
02;00.04	weg willy	['ʋɛχ 'wɪli]	['ʋɛχ 'lili]
02;00.04	willy	['ʋɪli]	['l̪̈liɸ]
02;00.04	willy	['ʋɪli]	['l̪̈eli]
02;00.04	willy	['ʋɪli]	['lili]
02;00.04	willy	['ʋɪli]	['jɪli]
02;00.04	willy	['ʋɪli]	['lɪli]
02;00.04	willy	['ʋɪli]	['lɛli]
02;00.04	willy getekend	['ʋɪli χə'tekənt]	['lɪli 'tekə]
02;00.28	fiets	['fits]	['tɪt]
02;00.28	fiets	['fits]	['ditə]
02;00.28	nou dit willy	['nɑu 'dɪt 'ʋɪli]	['nɑŭ 'di 'lɪldi]
02;01.08	boom tekenen Willy	['bom tekənən 'ʋɪli]	['bo 'tekə 'lili]
02;01.08	kadootje Willy	['kɑdotjə 'ʋɪli]	['koχ͡jə 'lɪli]
02;01.08	vliegtuig	['vliχtœyχ]	['titœyf]
02;01.08	vliegtuig	['vliχtœyχ]	[ʃə̆'sitœyf]
02;01.08	willy	['ʋɪli]	['lili]
02;01.08	wipwap	['ʋɪp̪ʋɑp]	['lɪp/la]
02;01.08	wipwap	['ʋɪp̪ʋɑp]	['lɪp/la]
02;01.22	nee willy	['ne 'ʋɪli]	['neĭ 'lili]
02;01.22	willy	['ʋɪli]	['lɪʃ͡ji]
02;01.22	willy	['ʋɪli]	['lɪli]
02;01.22	willy	['ʋɪli]	['lili]
02;02.06	fiets	['fits]	['tsɪ̆ts]
02;02.06	willy	['ʋɪli]	['dɪli]
02;02.06	Willy ook haren	['ʋɪli 'ʔok 'harən]	['lili 'ʔoχ 'halə]
02;02.06	wipwap	['ʋɪp̪ʋɑp]	['tind̪ap]

02;02.06	wipwap	['ʋɪpˌʋɑp]	['tindap]
02;02.06	zeven	['zevən]	['tejə]
02;02.27	ook dierentuin geweest	['ok 'dirənˌtœyn χə'ʋest]	['ʔok 'sn̥itœy'ne·s]
02;02.27	televisie	[ˌtelə'visi]	[ˌte's̻is̻ï]
02;02.27	willy	['ʋɪli]	['nɪli]
02;02.27	wipwap	['ʋɪpˌʋɑp]	['lilɑ]
02;02.27	wipwap	['ʋɪpˌʋɑp]	['lilɑ]
02;03.09	dat visje	['dɑt 'vɪsj͡ə]	['tɑ 'sisj͡ə]
02;03.09	kijk eens Willy	['kɛik 'ens 'wɪli]	['kɛikï 'lili]
02;03.09	televisie	[ˌtelə'visi]	[ˌsʰe's̻is̻i]
02;04.01	daar vlinder	['daɪ 'vlɪndəɪ]	['la̱ 'sɪnä]
02;04.01	en boerderij geweest	['ɛn ˌbuɪdə'ʀɛi χə'ʋest]	['ʔɛm ˌbulä'lq̣ 'leis]
02;04.01	flesje	['flɛs͡jə]	['slɛs͡jö]
02;04.01	vlinder	['vlɪndəɪ]	['tsɪnä]
02;04.01	willy	['ʋɪli]	['lɪli]
02;04.01	Willy ook appeltjes lekker	['ʋɪli 'ok 'apəltjəs 'lɛkər]	['lili 'ʔo 'ʔapə̆t͡jə̆ 'lɛkə]
01;11.20	olifant	['oliˌfɑnt]	['ʔɔə̆tɯˌtat]
01;11.20	olifant	['oliˌfɑnt]	['ʔotəˌta·t]
02;00.28	water	['ʋatəɪ]	['t͡ja·tə]
02;01.08	hier wortel	['hir 'wɔrtəl]	['hiə 'totɔ]
02;01.08	vasthouden	['vɑstˌhɑudə]	['tɑˌtʰɑuʋə]
02;01.08	vasthouden	['vɑstˌhɑudə]	['tɑˌtɑuʋə]
02;01.08	wortel	['ʋɔrtəl]	['tɑtɔw]
02;01.22	deze olifantje	['dezə 'ʔoliˌfɑnt͡jə]	['te 'hoˌt͡jɑt͡jə̆]
02;01.22	olifant	['oliˌfɑnt]	['totɑut]
02;01.22	olifant	['oliˌfɑnt]	['ʔotʀoʊ̆t]
02;02.27	gevallen	[χə'vɑlən]	[pə̆'talə]
02;03.09	bootje water	['bot͡jə 'ʋatəɪ]	['boːʃə 'latə]
02;03.09	ook bootje water	['ok 'botjə 'ʋatər]	['ʔo 'bo 'latə]
02;03.09	vos	['vɔs]	[sɔ'ʔɔs]
02;03.09	water	['ʋatəɪ]	['latə]
02;04.01	gevallen	[χə'vɑlən]	['sq̣lʉ]
02;04.01	gevallen	[χə'vɑlən]	['s̻alə]
02;04.01	zullen we andere Willy die even draaien	['zœlən ʋə 'ɑndərə 'ʋɪli 'di 'evən 'draijən]	['s̻ʉ ˌʔŭ 'ʔɑnələ 'lʉli 'di n̻ 'tʋaːijə]

(3) Apparent coronal harmony affecting labial stops in codas

01;10.09	knip	['knɪp]	['tɪt]

(4)Apparent coronal harmony affecting labial continuants in codas

01;09.23	duif	['dœyf]	['dœys̲]
02;01.08	alsjeblieft	['ɑlʃə̥blift]	[ˌʔɑsi'tist]

(5) Apparent coronal harmony affecting velars in onsets

01;10.09	kikker	['kɪkəɪ]	['titə]
01;10.09	knip	['knɪp]	['tɪt]
01;10.09	tekenen	['tekənə]	['te͡tjə]
01;10.09	tekenen	['tekənə]	['te'tə]
01;10.23	tekenen	['tekənə]	['tetə]
01;10.23	trein	['tʀɛin]	[tə̆'lɛi]
01;11.06	trui	['tʀœy]	[tə̆'lœy]
01;11.20	schildpad	['sχɪl̩pɑt]	['t̪ita:t]
01;11.20	schildpad	['sχɪl̩pɑt]	['teitat]
02;00.04	kip	['kɪp]	['tɪt]
02;00.04	tekenen	['tekənə]	['tetə̪t̪ɛ̪]
02;00.28	kijk eens	['kɛi̯kəns]	['kɛi̯jɪs]
02;00.28	kleien	['klɛijə]	['tɛinə]
02;01.08	rijden	['ʀɛidə ('ʀɛijə)]	['lɛijə]
02;01.08	trein	['tʀɛin]	['tlɛi]
02;01.22	grote poten	['χrotə'potən]	['tot 'totə]
02;01.22	grote staart	['χrotə 'start]	['to̯ta't]
02;01.22	kleine poten	['klɛinə 'potən]	['tɛi 'to͡tjə]
02;02.06	daar yogi	['daɪ 'joχi]	['ta: 'joçi]
02;02.06	glijden	['χlɛijə (χlɛidə)]	['nɛĭɲə]
02;02.06	kijk eens	['kɛi̯kəns]	['kacÿs]
02;02.27	sturen	['stʏʀə]	['tyjə]
02;02.27	sturen	['stʏʀə]	[sə'tylə]
02;03.09	strand	['stʀɑnt]	['tlœ̯ynt̪]
02;04.01	dit de boerderij	['dɪt də ˌbuɪdə'ɪʀɛi]	['tɪtə̈ ˌbulə̈'lɛi]
01;10.23	draaien	['dʀajən]	['djajə]
02;01.08	dat Rollo	['dɑt 'ʀɔlo]	['tɑə̆k 'lɔlo]
02;02.27	draaien	['dʀajən]	['tla:jə]
02;04.01	daar op	['daʀɔp]	['dalɔp]
02;04.01	daar op	['daʀɔp]	['da:dɔp]
02;04.01	daar op	['daʀɔp]	['talɔ]
02;04.01	daar op	['daʀɔp]	['dalɔ]
02;04.01	en boerderij geweest	['ɛn ˌbuɪdə'ʀɛi χə'ʊest]	['ʔɛm ˌbulä'lɑ̣ 'leis]

(6) Apparent coronal harmony affecting velars in codas

01;10.09	tiktak	['tɪk,tɑk]	['tɛtɪt]
02;01.22	dat ook stukmaken	['dɑt 'ok 'stʉkmakən]	['tɑ 'ʔo 'tys,takə]
01;11.06	tok tok tok	['tɔk ˌtɔk ˌtɔk]	['toutɔtɔt]

(7) Apparent coronal harmony targeting [h]

01;09.23	huilt	['hœylt]	['jœyt]

Appendix A3: Apparent Cases of Dorsal Harmony

(1) Apparent dorsal harmony affecting labial stops in onsets

02;01.08	kapot maken	[ˌkɑ'pɔt 'makən]	['kɔˌkakʉ]
02;01.08	open maken	['opə 'maken]	['ʔoˌχakə]
02;01.22	gitaar pakken	[χi'tar 'pɑkən]	['kaə̯̆ 'kɑχkʉ]
02;01.22	gitaar pakken	[χi'tar 'pɑkən]	['ta 'kaku]
02;01.22	klok maken	['klɔk 'makən]	['kɔχ 'kakə]
02;02.27	glijbaan	['χlɛiba.n]	['χɛiχan]
01;10.23	blokken	['blɔkən]	['kɔko]
02;00.28	pindakaas	['pɪndaˌkas]	['kika/s]
02;00.28	slaap monkey slaap	['slap 'mɔŋki 'slap]	['lapə 'kogi 'lap]
02;02.06	mijn boekje	['mɛin 'bukjə]	['mɛi 'kuk͡jə]
02;01.22	ook muisje maken	['ʔok 'mœysjə 'makən]	[no 'kɑuʃ̬ 'kakə]

(2) Apparent dorsal harmony affecting labial continuants in onsets

02;00.28	varken	['vɑɪkə]	['kɑk͡jəs]
02;04.01	olifantje	['oliˌfɑnt͡jə]	['hɔ̃ŋiˌkɑt͡jë]
02;00.04	dit is vogel	['dɪt 'ɪs 'voχəl]	['sχoχ̩]
02;00.04	vogel er uit	['voχəl ɛ'ʀœyt]	['χoχə̈ ˌdə 'ʔœyt]
02;01.22	grote vogel	['χrotə 'voχəl]	['χo 'χʊoχo]
02;01.22	struisvogel	['stʀœysˌvoχəl]	['sœyˌχoχoŭ]
02;01.22	vogel	['voχəl]	['χoχoŭ]
02;03.09	vogel	['voχəl]	['koˈχoŭ]

(3)Apparent dorsal harmony affecting coronals in onsets

01;05.27	tok tok	['tɔk ˌtɔk]	['kaːka]
01;06.27	tok tok tok	['tɔk ˌtɔk ˌtɔk]	['kɒkɒkɒ]
01;11.20	straks	['straks]	['kɑsˈt]
02;00.04	tiktak	['tɪkˌtɑk]	['tɪkɑik]
02;00.04	tiktak	['tɪkˌtɑk]	['tɪkak]
02;01.22	gitaar pakken	[χi'tar 'pɑkən]	['kaə̆ 'kɑχkʉ]
02;03.09	banaan	[ˌbɑ'nan]	[tɪ'ŋaːŋ]
02;03.09	banaan	[ˌbɑ'nan]	['ŋaːŋ]
02;04.01	olifantje	['oliˌfɑn͡tjə]	['hɔ̃ŋiˌkɑ͡tjë]
01;05.27	tok tok	['tɔk ˌtɔk]	['kɛkɛ]
01;05.27	tok tok	['tɔk ˌtɔk]	['kɔkɔ]
01;10.23	blokken	['blɔkən]	['kɔko]
01;11.06	trekker	['trɛkər]	['kekɛkɛk]
01;11.06	trekker	['trɛkər]	['kekɛkɛk]
02;00.04	schoenen	['sχunə]	['guŋə]
02;00.04	tekenen	['tekənə]	[te'kekə]
02;00.28	drinken	['dʀɪŋkən]	['kɪkə]
02;00.28	schoenen	['sχunə]	['kʊuŋə]
02;01.08	kadootjes	['kadotjəs]	['kokəs]
02;01.08	schoenen	['sχunə]	['kuŋə]
02;02.27	jongen	['jɔŋən]	['ŋɔŋə]
02;02.27	nog een keer	['nɔχ ən 'keɪ]	['kɔkeə]

(4) Apparent dorsal harmony affecting coronals in codas

02;02.06	op de kar	['ɔp də 'kɑr]	['ʔotɛ 'kɑk]
02;03.09	banaan	[ˌbɑ'nan]	[tɪ'ŋaːŋ]
02;03.09	banaan	[ˌbɑ'nan]	['ŋaːŋ]
01;11.06	trekker	['trɛkər]	['kekɛkɛk]
02;00.04	kalkoen	[ˌkɑl'kun]	['kuŋ]
02;02.06	kalkoen	[ˌkɑl'kun]	['koːŋ]
02;02.06	kalkoen	[ˌkɑl'kun]	['kuŋ]

Appendix B: Eva - Apparent Consonant Harmony

Appendix B1: Apparent Labial Harmony Harmony

(1) Apparent labial harmony affecting coronal stops in onsets

01;02.05	toren	['toʀə]	['bo̞wə]
01;06.11	postbode	['pɔst̪ˌbodə]	['tɔʂ̪'boːwə]
01;09.08	duplo	['dyplo]	['bʉ̟poː]
01;07.15	panda ook tandenpoetsen	['pɑnda 'ok 'tɑnd̪əˌput̪sə]	['pɑ̪moː 'pɑn̪də 'put̪ʃ̆əː]
01;08.12	tandenpoetsen	['tɑnd̪əˌputsə]	['pɑ̪maˌput̪əː]

(2) Apparent labial harmony affecting coronal continuants in onsets

01;04.12	sloffen	['slɔfə]	['pɔfɐ̟]
01;04.12	sloffen	['slɔfə]	['pɔɸə]
01;04.12	sloffen	['slɔfə]	['pɔfə]
01;04.12	sloffen	['slɔfə]	['pɔɸə]
00;08.04	sloffen	['slɔfə]	['pɔfə]
01;05.22	sloffen	['slɔfə]	['pɔfə]
01;05.22	sloffen	['slɔfə]	['pɔɸə]
01;02.05	ballon	[bɑ'lɔn]	['bɔ̃m]
01;02.05	slof	['slɔf]	['bɔf]
01;02.05	sloffen	['slɔfə]	['pɔfəː]
01;02.05	sloffen	['slɔfə]	['pˀɔ'fə]
01;02.05	sloffen	['slɔfə]	[ˌpɔfˀə]
01;06.11	sloffen	['slɔfə]	['pɔfə]
01;07.22	sloffen	['slɔfə]	['pɔfəː]
01;07.22	sloffen	['slɔfə]	['pɔfˀəː]
01;04.12	sloffen	['slɔfə]	['pɒɸə]
00;08.04	schaap	['sχap]	['faːp]
01;06.11	brilletje	['brɪlətjə]	['pɪʊë]
01;07.15	lepel	['lepəl]	['ʊë̟'pɔː]
01;08.12	schapen	['sχapə]	['pæ̟'pɔ̟ː]

(3) Apparent labial harmony affecting coronal stops on codas

01;04.12	brood	['bʀot]	['moˑp]
01;04.12	brood oma	['bʀot 'oma]	['moˑp 'oma]
00;08.04	brood	['bʀot]	['boːp]
01;05.22	brood	['bʀot]	['boŭp]
01;07.15	panda doen	['pɑnda 'dun]	['pɑmaː 'bu]
01;07.15	panda ook	['pɑnda 'ok]	['pɑˌmoˑt]
01;02.05	panda	['pɑnda]	['pɑmˑa]
01;02.05	panda	['pɑnda]	['pɑmˑa]
01;02.05	panda	['pɑnda]	['bɑmˑa]
01;07.15	één panda	['en 'pɑnda]	['ʔeːn 'pɑma]
01;07.15	nijlpaard	['nɛilˌpaɹt]	[ʋaːpʷ]
01;07.15	panda	['pɑnda]	['pɑ̃maː]
01;07.15	panda	['pɑnda]	['pɑˑmaː]
01;07.15	panda	['pɑnda]	['pɑma]
01;07.15	panda ook	['pɑnda 'ok]	['pɑ̆moːːt]
01;07.15	panda ook	['pɑnda 'ok]	['pɑmə 'oˑt]
01;07.15	panda ook tandenpoetsen	['pɑnda 'ok 'tɑndəˌputʂə]	['pɑm̪oː 'pɑn̪də 'puʈ̆ʂəː]
01;07.22	panda	['pɑnda]	['pɑmaː]
01;07.22	pandabeer	['pɑndaˈbeɹ]	['pɑ̪maˈbɪː]
01;08.12	panda	['pɑnda]	[ˌpɑˈmɔ̣ː]
01;08.12	panda	['pɑnda]	['pɑˌm̪aː]
01;08.12	tandenpoetsen	['tɑndəˌputsə]	['pɑ̪maˌpuʈ̪əː]
01;09.08	maan	['man]	['maːm]
01;09.08	panda	['pɑnda]	['pɑma]

(4) Apparent labial harmony affecting coronal continuants in codas

01;04.12	poes	['pus]	['puf]
01;04.12	poes	['pus]	['puɸ]
01;04.12	poes	['pus]	['puɸ]
00;08.04	poes	['pus]	['puf]
00;08.04	poes	['pus]	['puf]
01;02.05	poes	['pus]	[puf]
01;06.01	poes	['pus]	['puf]
01;06.11	poes	['pus]	['buˑf]
01;08.12	mes	['mɛs]	['ʋɛːf]

(5) Apparent labial harmony affecting velars in onsets

00;08.04	schaap	['sχap]	['faːp]
01;02.05	koffie	['kɔfi]	['pɔf]
01;02.05	koffie	['kɔfi]	['pɔf]
01;02.05	toren	['toʀə]	['bo̞wə]
01;07.22	koffie	['kɔfi]	['pɔfi]
01;07.22	opruimen	['ɔpˌʀœymə]	[ˌʔɔ'pœymə]
01;08.12	schapen	['sχapə]	['pæ̝'po̞ː]

(5) Apparent labial harmony affecting velars in codas

01;04.12	buik	['bœyk]	['bœup]
01;02.05	buik	['bœyk]	['boŭpʷ]

(6) Labial harmony caused by segmental insertion of another labial

01;02.05	poes	['pus]	['puɸs]

Appendix B2: Apparent Cases of Coronal Harmony

(1) Apparent coronal harmony affecting labial stops in onsets

01;04.12	bed	['bɛt]	['d̪ɛt]
01;04.12	bed	['bɛt]	['d̪ɛt]
01;04.12	prik	['pʀɪk]	['t̪ɪt̪]
01;04.12	prik	['pʀɪk]	['tɪt]
01;04.12	prikken	['pʀɪkə]	['teˇitə]
00;08.04	bed	['bɛt]	['d̪ɛ̣t]
00;08.04	bijten	['bɛitə]	['d̪ɛ̣itə]
00;08.04	prik	['pʀɪk]	['t̪ɪt̪ʷ]
01;05.22	Bert	['bɛɹt]	['d̪ɛt̪]
01;05.22	Bert	['bɛɹt]	['dɛt̪ʷ]
01;05.22	buik	['bœyk]	['dœyt]
01;05.22	prik	['pʀɪk]	['t̪œt̪ʷ]
01;02.05	Bert	['bɛɹt]	['d̪ɛt̪]
01;02.05	Bert	['bɛɹt]	['dɛtʷ]
01;02.05	buik	['bœyk]	['dœyt]
01;02.05	buik	['bœyk]	['dœ̣yt]
01;06.11	buiten	['bœytə]	['dœytə]
01;06.11	muis	['mœys]	['nœy̠s̠]
01;06.11	muis	['mœys]	['nø̞ˑsʷ]
01;06.11	muis	['mœys]	['nœis]
01;06.11	muis	['mœys]	['nœys]
01;07.15	muts op	['mʉts 'ɔp]	['nɪts 'ʔɔp]
01;09.08	bijna klaar	['bɛina 'klaɹ]	[ə'vɛi/ 'dɛiñã 'taːɹ]
01;09.08	bijna klaar	['bɛina 'klaɹ]	['dɛina 'taˑɹ]
01;09.08	bijna klaar	['bɛina 'klaɹ]	['tɛinə̈ 'taːɹ]
01;09.08	weer bijna klaar	['ʋeɹ 'bɛina 'klaɹ]	['ʋeɹ 'tɛin 'paˑʔ]
01;09.22	glijbaan	['χlɛi̯ban]	['tɛi̯n̪aːnə]
02;03.27	spijkers	['spɛikəɹs]	['tɛit̪is]
01;06.11	bad	['bɑt]	['tɑ̣ːt]
01;06.11	plassen	['plɑsə]	['tɑs̠ə]
01;06.11	postbode	['pɔstˌbodə]	['tɔs̠'boːwə]
01;06.11	puzzel	['pʉzəl]	[t̪ʉs̠ə]
01;08.12	kapot maken	[ka'pɔt 'makə]	[ˌo'pɔ ˌnaːtə]
01;08.12	kapot maken	[ka'pɔt 'makə]	[ˌʔo'pɔt̚ 'naːt̪ʷə]
01;09.08	nee potlood	['ne 'pɔtˌlot]	[ne 't̪ʰɔˌd̪oːt]

00;08.04	maken	[ˈmakə]	[ˈnaːtə]
01;07.22	paraplu	[ˌpaʁaˈply]	[ˈpiŭˈt̪yː]

(2) Apparent coronal harmony affecting labial continuants in onsets

01;11.08	ik vies heb, vieze handen	[ɪk 'vis 'hɛp 'vizə 'hɑndə]	[ʔɪt 'ʋiˈʈɛp 'tsiˈt ʔɑn̪ð̪i]
01;02.05	vis	['vɪs]	[p'dɪs]
01;02.05	fles	['flɛs]	['dɛs]
01;02.05	vis	['vɪs]	['z̆ɪs]
00;08.04	kwak	['kʋɑk]	['taˈt]
01;02.05	water	['ʋatəɪ]	['tɑtʷəː]

(3) Apparent coronal harmony affecting labial stops in codas

01;09.08	oma komt	['oma 'kɔmt]	[ʔoˈma 'tɔnt]
01;09.08	oma komt	['oma 'kɔmt]	[ʔoˈma 'tuˈnt]

(4) Apparent coronal harmony affecting velar stops in onsets

01;04.12	prikken	['pʀɪkə]	['teʔitə]
00;08.04	kers	['kɛɪs]	['tɛʂ]
00;08.04	kijk	['kɛik]	['tɛi̯t]
00;08.04	kijk	['kɛik]	['tɛit]
00;08.04	kijken	['kɛikə]	['tɛitə]
01;05.22	kindje	['kɪnt̪jə]	['tiɲ]
01;02.05	tekenen	['tekənə]	['teːtɛ]
01;06.11	andere kijken	['ɑndərə 'kɛikə]	['ɑ̟në 'tɛitə]
01;06.11	kijk	['kɛik]	['tɛit]
01;06.11	kijken	['kɛikə]	['tɛitə]
01;07.15	creche	['kʀɛʃ]	['tɛʂ]
01;07.15	hij is krant (aan het) lezen	['ɦɛi 'ɪs 'kʀɑnt 'lezə]	['hɛ ˌɪsə 'tɑn̪ 'l̪eːtə/səː]
01;07.15	kijk	['kɛik]	['tɛit]
01;07.15	kijk	['kɛik]	['tɛ̟ːit]
01;07.15	oma kijken	['oma 'kɛikə]	['ʔoma 'tɛ̟itəː]
01;07.15	zitten mama kijk	['zɪtə 'mɑma 'kɛik]	['tɪ̟tə u mɑ̟'mə̃ etɛit]
01;07.22	daar kijken	['daɪ 'kɛikə]	['d̪aˑ 'tɛ̟itəː]
01;07.22	oma kijken	['oma 'kɛikə]	['ʔoma 'tɛitʷəː]
01;07.22	poes kijken	['pus 'kɛikə]	['puʂ 'ʈæitə]
01;07.22	poes kijken	['pus 'kɛikə]	['puː 'tɛitə]
01;08.12	kijk	['kɛik]	['tɛ̟it]
01;08.12	kijk eens	['kɛiˌkəns]	['tɛiˌtɪs]
01;08.12	kikker	['kɪkəɪ]	['t̪ɪ̟t̪əˑ]
01;08.12	oma kijken	['oma 'kɛikə]	['ʔomə̆ ˌtɛ̟itə]
01;09.08	kijk eens	['kɛiˌkəns]	['tɛiˌtəʂ]
01;09.08	leeuw kijken	['leu 'kɛikə]	['zeŭ 'tæiˌt]
01;09.08	leeuw kijken wil	['leu 'kɛikə 'ʊɪl]	['leɔ 'tɛitə 'ʊɬ]
01;09.08	Marieke	[maˈʀikə]	['jitəː]
01;09.08	weer klaar	['ʋeɪ 'klaɪ]	['ʋ̟ɪ 'taɪ]
01;09.22	glijbaan	['χlɛiˌban]	['tɛiˌn̪aːnə]
01;09.22	kijk eens	['kɛiˌkəns]	['tɛi'tɪʂ]
01;09.22	kijk eens	['kɛiˌkəns]	['tɛiˌtis]
01;09.22	kijk eens	['kɛiˌkəns]	['tɪ̟ː ˌtɪːs]
01;09.22	Loet kijken	['lut 'kɛikə]	['luˑ 'tɛitə]
01;09.22	wij ook kleien	['ʋɛi 'ok 'klɛijə]	['ʋɛi 'o̟kˇ 'tɛijə]
02;03.27	kijken	['kɛikə]	['tɛitə]
02;03.27	spijkers	['spɛikəɪs]	['tɛit̪is]
00;08.04	kwak	['kʊɑk]	['taˑt]

00;08.04	maken	['makə]	['naːtə]
01;06.11	kaas	['kas]	['taːs̪]
01;06.11	klok	['klɔk]	['tɔt]
01;07.15	kan niet	['kɑn ˌnit]	['tɑn̪ːiːt]
01;07.22	kan niet	['kɑn ˌnit]	['tɑ̪ˈn̪ˈi]
01;07.22	klok	['klɔk]	['tɔːt]
01;08.12	kachel	['kɑχəl]	['tɑˈˌtɔχ]
01;08.12	kapot maken	[kaˈpɔt 'makə]	[ˌoˈpɔ ˌnaːtə]
01;08.12	kapot maken	[kaˈpɔt 'makə]	[ˌʔoˈpɔt̚ 'naːt̪ʷə]
01;08.12	klok	['klɔk]	[t̪ɔtʷ]
01;08.12	klok	['klɔk]	[t̪ɔtʷ]
01;09.08	bijna klaar	['bɛina 'klaɪ]	['bɛin 'taːɪ]
01;09.08	bijna klaar	['bɛina 'klaɪ]	[əˈʊɛi/ 'dɛiŋ̆ã 'taːɪ]
01;09.08	bijna klaar	['bɛina 'klaɪ]	['bɛiŋ̆ă 'taːɪ]
01;09.08	bijna klaar	['bɛina 'klaɪ]	['dɛina 'taˈɪ]
01;09.08	bijna klaar	['bɛina 'klaɪ]	['tɛinɑ̈ 'taːɪ]
01;09.08	bijna klaar	['bɛina 'klaɪ]	['ʊɛinə t̪aːɪ]
01;09.08	bijna klaar	['bɛina 'klaɪ]	['bɛina 'taːɪ]
01;09.08	bijna klaar	['bɛina 'klaɪ]	['ʊɛina 'taːɪ]
01;09.08	die ook krokodil	['di 'ok ˌkroko'dɪl]	[ˌdi 'joŭ 'toto'dɪɔ̚]
01;09.08	kan niet	['kɑn ˌnit]	['tɑnitʷ]
01;09.08	kan niet	['kɑn ˌnit]	['tɑˈˌnit]
01;09.08	kan niet	['kɑn ˌnit]	[t̪ɔn̪it]
01;09.08	kan niet bij	['kɑn 'nit 'bɛi]	['tɑn̪i 'bɛ̤i]
01;09.08	oma komt	['oma 'kɔmt]	[ʔoˈma 'tuˈnt]
01;09.08	oma komt	['oma 'kɔmt]	[ʔoˈma 'tɔnt]
01;09.08	zo klaar	['zo 'klaɪ]	['s̪oŭ 'taːɪ]
01;09.22	(dat zou) ik niet kunnen	[('dɑt 'zɑu) 'ɪk 'nit 'kɯnə]	['ʔit 'nitə 'tɯnə]
02;03.27	kan niet uit	['kɑn 'nit 'œyt]	['tɑniˈtœyt]
02;03.27	klok	['klɔk]	['tɑ̤t]
01;11.08	koffiekoekje	['kɔfiˈkukjə]	['kɔfɪ̯tutjɛ̈]
01;11.08	Marieke komt	[maˈʁikə 'kɔmt]	['niˈt 'kɔm̆t]

(5) Apparent coronal harmony affecting velar continuants in onsets

01;11.08	gele	['χelə]	['ʂeːlə]
01;11.08	groen	['χʀun]	['tyn]
01;11.08	dat is gele	['dɑt ˌɪs 'χelə]	['dɑtɪs 'tʂeˈlə]
01;07.15	die gegeven (?) papa	['di χə'χevə 'pɑpa]	['di ǰeːtə 'pɑˈpa]
01;08.12	kachel	['kɑχəl]	['tɑˌtɔχ]
01;02.05	getsie	['χɛtsi]	['dæːt]

(6) Apparent coronal harmony affecting velar stops in codas

01;04.12	prik	['pʀɪk]	[ˈt̪ɪt̪]
01;04.12	prik	['pʀɪk]	['tɪt]
00;08.04	kijk	['kɛik]	['tɛi̯t]
00;08.04	kijk	['kɛik]	['tɛit]
00;08.04	kwak	['kʋɑk]	['taːt]
00;08.04	prik	['pʀɪk]	[ˈt̪ɪt̪ʷ]
01;05.22	buik	['bœyk]	['dœyt]
01;05.22	prik	['pʀɪk]	[ˈt̪œt̪ʷ]
01;02.05	buik	['bœyk]	['dœyːt]
01;02.05	buik	['bœyk]	['dœ̯yt]
01;06.11	kijk	['kɛik]	['tɛit]
01;06.11	klok	['klɔk]	['tɔt]
01;06.11	strik	['stʀɪk]	['tɛt̪ʷ]
01;06.11	tiktak	['tɪkˌtɑk]	['tɪ'tɪt]
01;07.15	deksel	['dɛksəl]	['dɪt̪s̪oː]
01;07.15	kijk	['kɛik]	['tɛit]
01;07.15	kijk	['kɛik]	['tɛ̯ːit]
01;07.15	zitten mama kijk	['zɪtə 'mɑma 'kɛik]	['t̪ɪtə u mą'mɑ̃ etɛit]
01;07.22	deksel	['dɛksəl]	['dɛːtʷsɑ]
01;07.22	klok	['klɔk]	['tɔːt]
01;08.12	kijk	['kɛik]	['tɛ̯it]
01;08.12	klok	['klɔk]	[t̪ɔtʷ]
01;08.12	klok	['klɔk]	[t̪ɔtʷ]
01;09.08	deksel	['dɛksəl]	['dɪtsoˌɔp]
01;09.08	deksel op	['dɛksəl 'ɔp]	['dɪtsoˑ / ʔˈɔp]
01;09.08	ik ook	['ɪk 'ok]	['ʔi 'toːt]
01;09.22	Bert ook	['bɛɪt 'ok]	['bɛˑ 'toːt]
01;09.22	ik ook glijbaan	['ɪk 'ok 'χlɛiˌban]	['ʔi'toːt 's̪ɛima]
01;09.22	ik ook zandbak spelen	['ɪk 'ok 'zɑmˌbɑk 'spelə]	['ʔi'to̯tə 'sɑmˌbɑʔ 'peːlə]
01;09.22	Loet ook	['lut 'ok]	['luːtoˑt]
01;09.22	rok	['ʀɔk]	['lɔt]
02;03.27	klok	['klɔk]	['tˌt]
01;11.08	koffiekoekje	['kɔfi'kukjə]	['kɔf̪ɪtjë]
01;11.08	oma heb ook zakdoek	['oma 'hɛp 'ok 'zɑkˌduk]	['ʔoŭməˈɛp 'oˑk̟ 's̪ɑkˌdut]

Appendix B3: Apparent Cases of Dorsal Harmony

(1) Apparent dorsal harmony affecting coronals in onsets

01;11.08	Eva aaien toch	['eva 'aijə 'tɔχ]	['ʔefə 'ai 'kɔχ]
01;11.08	op dak	['ɔp 'dɑk]	['ʔɔpə̂ 'gɑk]